E-Business Impact on SCM in the apparel industry operating between a developing and a developed economy

A Thesis submitted for the degree of Doctor of Philosophy

By

Asanka Hiroshana Horadugoda Gamage

Faculty of Enterprise and Innovation

Buckinghamshire Chilterns University College

Brunel University

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Abstract

This thesis examines the impact of e-Business in the B2B segment of the Supply Chain between UK retailers and Sri Lankan manufacturers in the apparel sector.

The literature review explored four interrelated themes, two of them informed by an exploratory study. Research collating these four themes is scarce, especially in the apparel sector although there is considerable research on supply chain management and information sharing, which adopts a quantitative approach. However, there is a relative lack of qualitative research into behavioural issues. Based on the literature review, 12 main research questions were formulated.

Following a qualitative, approach respondents in five Sri Lankan apparel manufacturers were interviewed in an explanatory study comprised of 35 interviews. An innate analytical framework consisting of themes, attributes and categories (TAC) was developed for data analysis. A conceptual model incorporating three category combinations was developed, disclosing internal, external and holistic reasons for ICT implementation.

Analysis of the findings suggests that, more than speed of delivery, visibility of information is the main benefit facilitated by new ICT, compared with traditional methods. The findings indicate that security is the main concern and the main barrier is remote plant location for conducting e-Business. The data indicate that 80 per cent of investigated companies do not have an appropriate level of ICT capability. Moreover, a manufacturer's communication capability and information sharing are mainly decided by the dependency on the lead firm. Manufacturers that deal with multiple lead firms experience compatibility problems due to the lack of a hybrid system. Manufacturers also need to set realistic expectations for a communication system and employee motivation should be included in the evaluation criteria. In conclusion, building a few longer-term relationships, including an information sharing policy is considered crucial for achieving the true potential of e-Business.

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I dedicate this thesis to all those who lost their lives by the South Asian Tsunami

My dearest Aththamma you are often in my thoughts

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Abbreviations

AC	Access Control
AB	Anecdotal Benefits
AE	Appropriateness of Expectations
AI vs. PI	Actual Impact vs. Perceived Impact
AP	Anecdotal Problems
AR	Accurate Response
ARP	Automatic Replenishment Program
B2B	Business to Business
B2C	Business to Consumer
BOM	Bill of Material
BSR	Buyer Supplier Relations
BSC	Buyer Supplier Coordination
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CBSL	Central Bank of Sri Lanka
CD	Compact Disc
CDMA	Code Division Multiple Access
CEO	Chief Executive Officer
CPFR	Collaborative Planning Forecasting and Replenishment
CPI	Communication Platform Integration
CM	Cut and Make
CRM	Customer Relationship Management
CRP	Continuous Replenishment Programs
CSM	Customer Service Management
CSV	Cross Structural Visibility
CTM	Concept to Market
DTI	Department of Trade and Industry
DM	Demand Management
DF	Data Filtering
EB	Electronic Business
EBD	Export Development Board
EBSR	Effects on Buyer Supplier Relations
EC	Electronic Commerce
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
EDL	E-Development Labs
ENC	Electronic Network Communications
EPOS	Electronic Point of Sale
ERP	Enterprise Resource Planning
eSC	Electronic Supply Chain
EU	European Union
FDI	Foreign Direct Investment
FFRA	Freight Forwarder Reverse Auctioning
FOB	Freight on Board
GDP	Gross domestic Product
Hyp	Hyperbole
ICT	Information Communication Technology
ICTA	Information Communication Technology Agency
ICTI	Information Communication Technology Implementation
IDD	International Direct Dialling

ILT	Institute of Logistics and Transport
IPOM	Institute of Production and Operations Management
IT	Information Technology
JIT	Just in Time
JSCM	Journal of Supply Chain Management
LDP	Landed Duty Paid
LF	Level of Functionality
LIS	Level of Information Sharing
LSE	London School of Economics
MD	Managing Director
MFA	Multi Fibre Agreement
MFM	Manufacturing Flow Management
MM	Materials Management
OED	Oxford English Dictionary
OF	Order Fulfilment
Ops	Operations
PC	Platform Capability
PDM	Physical Distribution Management
PO	Purchase Order
QI	Quantity of Information
QR	Quick Response
RLF	Role of Lead Firm
RTPS	Real Time Production System
RTS	Resource Transaction System
SAP	System Application Program
SBU	Strategic Business Unit
SC	Supply Chain
SCC	Supply Chain Coordination
SCDICT	Shift in Communication with Different Information Communication Technology
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference
SEA-ME-WE-IV	South East Asia-Middle East West Europe IV
Sec	Security
SME	Small to Medium Enterprise
SLT	Sri Lanka Telecom
Strg	Strategic
SWOT	Strengths Weaknesses Opportunities Threats
TA	Themes and Attributes
TAC	Themes Attributes Categories
TCF	Textile Clothing and Footwear
TEU	Twenty-foot Equivalent Container
TIS	Type of Information Sharing
Trans	Transactional
TRCSL	Telecommunication Regulatory Commission of Sri Lanka
UCT	Unit Container Terminal
UNICEF	United Nations Children's Fund
USITC	United States International Trade Commission
VAN	Value Added Network
VMI	Vendor Managed Inventory
VPN	Virtual Private Network
WAN	Wide Area Network

CHAPTER 1 INTRODUCTION

1.1 Introduction to the thesis

E-Business provides the opportunity for virtual shortening of the supply chain as it extends around the world. This thesis examines the implications for integrating supply chain partners. The advent of the Internet has undoubtedly facilitated movement of data faster and more cheaply than ever before. Consequently the commercial sector is taking a keen interest in developing the concept of e-Business. Despite the publicity surrounding this phenomenon, a clear view of its capabilities and limitations does not yet appear to be established in academic literature.

It is an interesting prospect to investigate the benefits argued by researchers in this field and determine the true effectiveness of e-Business without the hyperbole created partly by companies such as Microsoft and IBM. The nature of competition suggests that, regardless of technological capabilities, companies may prefer to adopt an information policy on a 'need to know basis' in order to preserve competitiveness. If this claim is true: are companies anticipating benefits, which cannot be achieved simply by employing e-Business? How effective is e-Business compared to its predecessors? Are they implementing e-Business to 'jump on the bandwagon'? Are they implementing an expensive system they do not need?

Answering the call for research from authors such as Auramo *et al* (2002), Golicic *et al* (2002), Gubi *et al* (2003) and Croom (2005) this research project aims to empirically investigate the impact of e-Business on supply chain management. The research will be conducted in the context of the apparel supply chain between the UK and Sri Lanka, representing a developed and a developing economy. This context was selected because there is a gap in the literature discussing e-Business impact on the apparel industry. The growing apparel sector in Sri Lanka and the current trend of UK retailers to outsource their manufacturing function through emerging economies reinforce this choice. Authors (e.g. Popp, 2000; Bruce *et al*, 2004; Christopher *et al*, 2004 and Guercini and Runfola, 2004) call for further research in to supply chain (SC) practices in the apparel industry. From an academic perspective it appears useful to understand current trends

and the future direction of the international apparel supply chain.

1.2 Aim of the research

The idea to undertake this research project was fuelled by the heightened interest surrounding e-Business. Anecdotal arguments made by academics and practitioners suggest that e-Business can restructure supply chain operations through better communications. The growing importance of e-Business is evident by the number of books titled e-supply chain management, universities offering courses in e-Business and the international conferences focusing on a range of e-Business areas from e-Logistics, e-Commerce and e-Procurement to e-Sourcing.

This study aims to analyse the impact of e-Business on SC processes from an emerging economy's perspective within the discipline of operations management. Essentially this research intends to explore the operational performance of information communication technology (ICT) by comparing e-Business and pre-e-Business tools usage in supply chain management (SCM) in the Sri Lankan apparel sector through a thematic approach. Specifically this PhD study evaluates:

- The effectiveness of e–Business on supply chain operations, (i.e. its influence on information sharing and buyer-supplier relationships), compared to previous information communication technology.

In this investigation, Sri Lanka acts as the context of the research rather than the research field. Therefore the aim is to identify the impact of ICT on supply chain management in the context of the apparel sector in Sri Lanka rather than an in-depth exploration of Sri Lankan apparel sector practices.

1.3 Exploratory fieldwork

A preliminary field investigation highlighted several important topics. These include: order cycle times, level of information sharing, buyer-supplier relations (e.g. influence from the retailer to implement technology and retailer acting as the lead firm in the SC)

and paper free processes. Out of these topics, two were perceived as being particularly important by the respondents. They were: level of information sharing and buyer-supplier relations. The selected topics were subject to a literature review. Interviews were conducted with the technology development division of an apparel group. The interviews provided brief but interesting insights into some operational and management issues. In total, six interviews were scheduled. However, only five interviews were possible because one interview was cancelled by the participant due to time restrictions[1]. The positions held by these interviewees were: Executive Director – Technology, information communication technology (ICT) manager, software implementation consultant, system application program (SAP) business analyst, Executive Director – Logistics and an assistant General Manager.

Interesting insights were gained on technology assessment from the interviewees. The executive director of technology claimed that a leading UK retailer, whose name cannot be revealed for confidentiality purposes, constantly applies pressure to implement new technology to facilitate systems integration. This raises important questions such as: would the new information communications technology (ICT) be equally beneficial for both partners, considering that the retailer gains more control and a high implementation cost is incurred by the manufacturer? Is the stronger retailer unduly pressuring the weaker manufacturer in a buyer's market? Compared to the previous technology, do the benefits of e-Business outweigh the cost? Referring to one particular situation regarding electronic data interchange (EDI) technology a respondent stated:

> *They told us if you cannot implement the required EDI system you would not get next season's orders.*

The exploratory fieldwork also identified background information about the Sri Lankan apparel industry. It identified the supply chain processes from the point of ordering the product to stock arrival in the UK. (See Appendix A for a diagrammatic illustration of the order cycle). According to a large apparel manufacturer with 5000 employees, it takes on average 120 days lead-time to deliver an order to a UK retailer from the time of

[1] In one instance two participants were available for interviewing. As a consequence a better dialogue about the research mater was possible.

receiving the purchase order (PO). Industry specialists in Sri Lanka, such as the SAP business analyst and executive director – logistics, claim that, with e-Business, order cycle times would reduce by cutting the number of days spent on communicating between processes. The whole order cycle process is conducted in four main steps.

First step: After identifying the material required for the design the retailer informs the materials supplier. From the point the purchase order is made the first step is notifying the materials suppliers.

Second step: On average it takes 30 days for the material to be received by the manufacturer. The manufacturer sends a sample of the fabric to be tested (usually in India due to close geographic location).

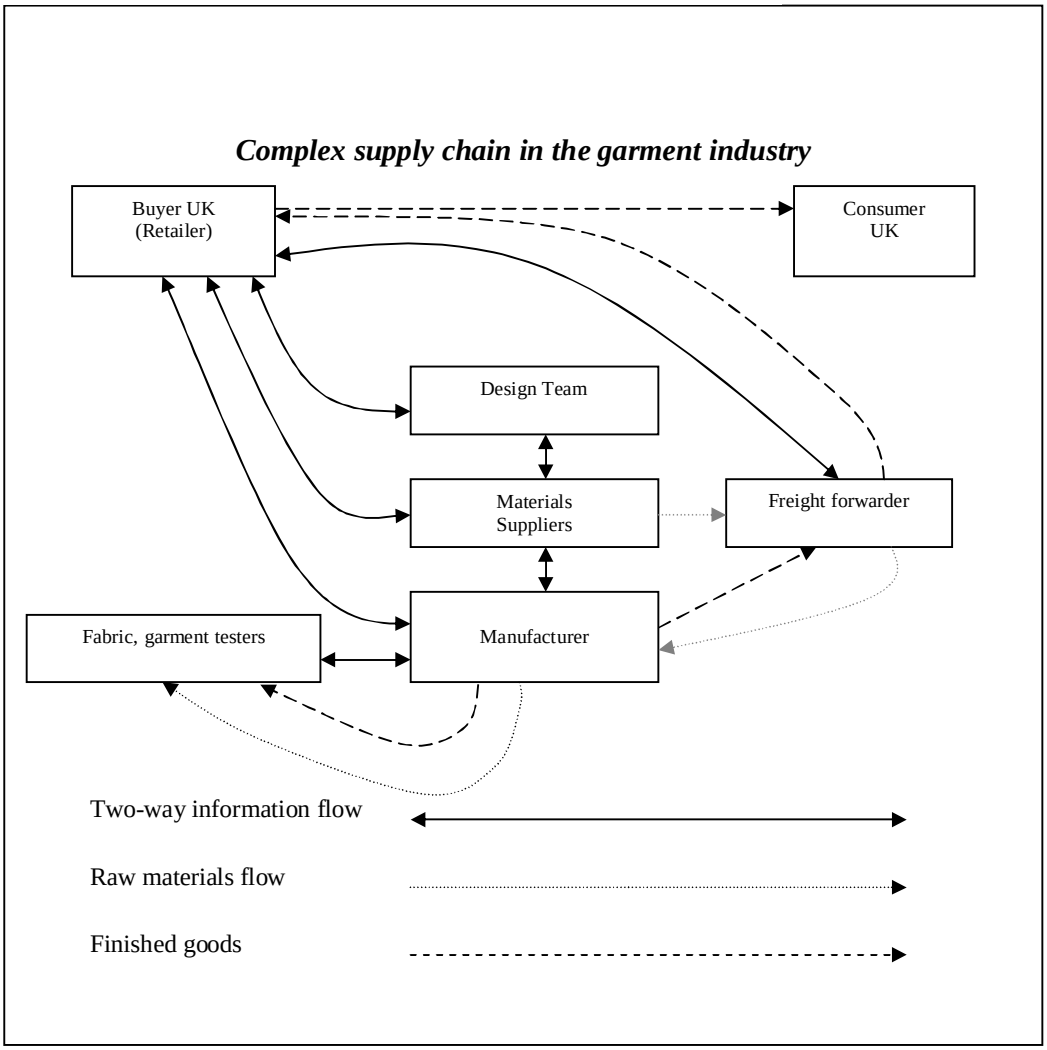
Third step: Production commences. A sample of a finished garment is tested (again usually in India).

Fourth step: The final quality inspection is conducted by the manufacturer before shipping the cargo to the UK retailer.

The preliminary investigation was intended to be an exploratory study with the purpose of identifying suitable lines of inquiry to identify the research path. It achieved its goal of identifying a generic picture of *what* is happening in the Sri Lankan apparel industry (with regard to the impact of ICT) but it lacked quantity and quality of detail to determine *why* such practices are occurring and *how* supply chain processes are affected by differences in information communication technology (ICT). The preliminary investigation also had several methodological limitations such as: opportunistic planning, small number of interviews, and time constraints. Nevertheless, the lessons learnt from the preliminary fieldwork aided the subsequent field research stage. The sections 3.5 to 3.5.2.2 discuss the approach taken during the subsequent field research stage. Figure 1.1 illustrates the flow of information, raw materials and finished goods in the apparel supply chain. This diagram illustrates a 'typical' supply chain process, including the end consumer. In figure 1.1, information is exchanged seven times compared to exchanges of raw materials (three times) and finished goods (four times).

This provides an indication of how important information sharing is in supply chain management.

Figure 1.1 Three flows operating in a supply chain



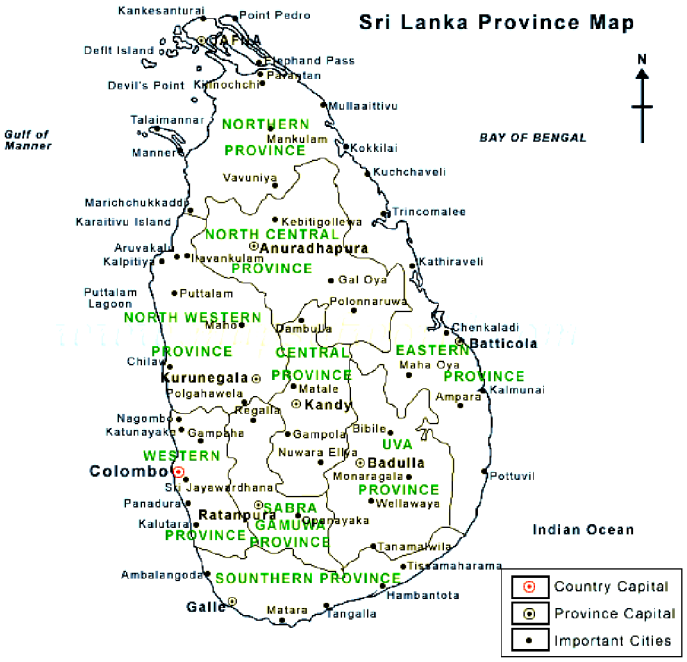
The insights gained on buyer-supplier relationships suggest that the UK retailer mostly controls the supply chain activities, from technology implementation, nominating the materials suppliers to determining how many quality checks are needed before the goods are sent to the UK. According to some practitioners, like the software implementation consultant and the ICT Manager, manufacturers are increasingly aware of the benefits of forming alliances with other external parties such as material suppliers. With regards to 'level of information sharing', the respondents revealed that new ICT tools have considerably increased the volume of information exchanged

between the SC partners. This change provides them opportunity to integrate information from different departments and to create new channels of intra and inter organisational communications. Section 3.3 further discusses the importance of the selected topics.

1.4 Research site

The Democratic Socialist Republic of Sri Lanka contains nine provinces and further sub-division into twenty-five districts[2]. Most of the research was conducted in the Western Province in the western part of the country in the areas of Nagombo, Katunayaka, Colombo and Panadura. See Figure 1.2 to view these sites on the map of Sri Lanka.

Figure 1.2 Sri Lanka Province MAP



Source: InfoBase Limited

[2] Sri Lanka is located in the Indian Ocean, between the geographic coordinates 700 N, 81 00 E. The island is 225 km across at the widest points and 435 km long with a total land area of 65, 610 sq km.

This section presents an overview of the research environment involved with this study such as the apparel industry in Sri Lanka, economy, telecommunication industry and port services. These areas are central to the apparel industry operations. For example, the telecommunication industry provides the infrastructure needed for ICT in the SC and the state of the economy decides the currency exchange rate. Consequently, economic conditions impact on raw material purchasing and manufacturing costs. Similarly, port services are a vital part of materials management and physical distribution management. Processing times at the ports play a major role on the delivery time lines.

1.4.1 Apparel industry

Developing countries account for one-third of global textile exports worth over US$ 300 billion. The textile and garment industries have been the first step towards industrialisation of developing countries like Sri Lanka. Developing countries earn much-needed foreign exchange from this industry, providing employment and incomes. The Sri Lankan textile and garment industry has emerged from a modest beginning in the early 1950s to become the largest industry in the Sri Lankan economy. Before 1977, the government ran the textile industries. Importation and distribution of raw material were tightly controlled and the import of textiles was restricted. As a result, the textile industry was unable to make progress during this period. The garment industry emerged in the mid-1960s, but unlike the textile industry, the private sector claimed ownership and since then has become a success story (Kelegame, 2004b).

The growth of the garment industry since 1977 can be attributed to three main reasons. The first is the market-oriented, liberal economic policies. Second are the supportive measures taken by the government through the Board of Investment (BOI), such as duty free importation of raw material, off-shore borrowing facilities and confessional taxation. The third was the Multi-Fibre Agreement (MFA). Foreign garment manufacturers relocated their factories to countries like Sri Lanka and Indonesia to take advantage of the ‘quota system’. Underutilised quotas also prompted a quite large number of local entrepreneurs to enter the garment industry (Kelegame, 2004b).

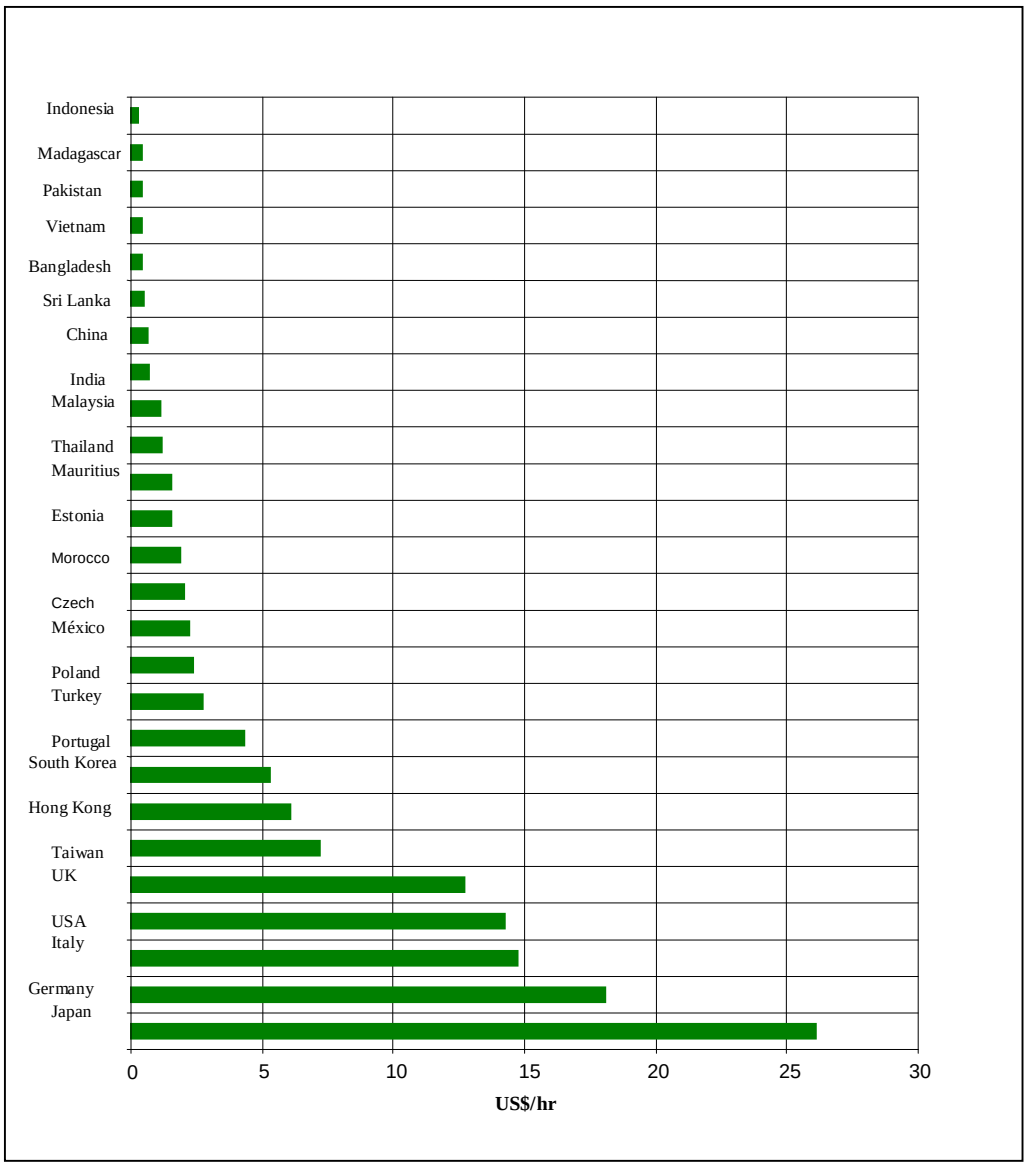
By 2005, Sri Lanka's textile and garment sector accounted for 6.2% of GDP, 39% of industrial production, 46% of total exports and 58% of industrial exports (CBSL, 2006). In 2002, 15% of foreign direct investment (FDI) was reported in this sector (Kelegama, 2004b). Foreign investors own 50% of total garment factories and account for 90% of total textile and garment exports (USITC, 2004). A weak point in this industry is that there is great dependence on imported textile, as the local textile industry operates only on a very small scale. Data suggest that there are about 859 garment-manufacturing enterprises registered with the Sri Lanka customs. Of these facilities, over 80 per cent are categorised as small and medium scale enterprises (SMEs) (by value of exports) accounting for 28 per cent of the total value of garment exports. The remaining 12 per cent of exporters, which are classified as large, contribute the bulk of the revenue of the industry accounting for 72 per cent (Wilson, 2003).

The manufacturing sector accounts for 16.8 per cent of the labour force and the garment industry employs one-third of manufacturing sector employment. According to the Ministry of Industries, the garment sector provided direct employment to approximately 391,682 employees in 2001. A conspicuous characteristic of the Sri Lankan garment industry is that females dominate the work force with 87 per cent. Another feature of the garment industry is that over 70 per cent of garment manufacturers are concentrated in or around the Western Province. This is due to better infrastructure and close proximity to seaports and airport facilities. Similarly, 65 per cent of total employment has been generated in the region. The labour force is a key feature in the garment sector because competitive prices are important to attract Western clothing retailers. Sri Lanka has managed to establish itself as a quality garment producer for the mass market. Sri Lanka's labour charges are competitive with other regional economies like India, Pakistan, or Indonesia. Figure 1.3 presents a comparison of the apparel industry labour charges of several countries.

Sri Lanka currently manufactures a wide range of well known international branded clothing such as Victoria's Secrets, Liz Claiborne, Pierre Cardin, Abercrombie and Fitch, Nike, GAP, Ralph Lauren, Marks and Spencer, and Tommy Hilfiger. Sri Lanka is trying to promote itself as a quality manufacturer rather than a low cost manufacturer.

Experts at EDB[3] believe that orders will continue even though the trade barriers have been liberalised (i.e. post MFA). Appendix B provides a summary of a SWOT analysis of the apparel industry in Sri Lanka.

Figure 1.3 Labour Cost Comparisons in the Textile Industry, 2000



Source: Kelegama, (2004b:29)

[3] Assistant director apparel sector

1.4.2 Economic conditions

Since regaining independence in 1948, the Sri Lankan economy has seen fluctuations caused by political instability. Table 1.1 presents a summary of the economic situation of Sri Lanka in 2006. With a population of about 20 million inhabitants, Sri Lanka has a GDP per head of US $ 4,600 (2006 est.)[4], a higher rate than many other neighbouring countries such as India, Pakistan and Indonesia.

Table 1.1 Sri Lankan's economy

Currency:	Sri Lankan rupee (LKR)
Exchange rate:	US$1 = LKR 102.987 (2006)
GDP:	$ 93.33 billion (PPP*, 2006 est.)
GDP growth rate:	6.3% p.a. (2006 est.)
GDP per capita:	$ 4,600 (PPP*, 2006 est.)
GDP consumption by sector:	*Agriculture* 17.3% *Industry* 27.3% *Services* 55.3% (2006 est.)
Inflation rate:	12.1% p.a. (2006 est.)
Labour force:	8.214 million (2006 est.)
Labour force by occupation:	*Agriculture* 38%, *Industry* 17% *Services* 45% (1998 est.)
Unemployment rate:	7.6% (2006 est.)
Government budget:	*Revenue and grants* $ 4.762 billion *Expenditure* $ 7.095 billion including capital expenditure (2006 est.)
Population below poverty line:	22% (1997 est.)
Industries:	Rubber processing, tea, coconut, other agricultural commodities, garments, tobacco, cement, petroleum refining, insurance, telecommunications and banking
Industrial production growth rate:	7.1% p.a. (2006 est.)
Electricity production:	7.714 billion kWh (2004)
Electricity consumption:	7.714 billion kWh (2004)
Exports:	$ 7.076 billion (f.o.b. 2006 est.)
Export partners:	US 31.1%, UK 12.2%, India 8.9%, Germany 4.3% (2005)
Imports:	$ 9.655 billion (f.o.b. 2006 est.)
Import partners:	India 20.7%, Singapore 8.3%, Hong Kong 7.3%, China 7.3%, Iran 5.9%, Malaysia 4.4%, Japan 4.3% (2005)
Fiscal year:	Calendar year

Note * based on purchasing power parity (PPP).Source: Central Bank of Sri Lanka *Annual Report 2006*, CIA (2006) *The World Fact Book 2006*, IMF Country Report 06/446 EDB export performance report 2004, Kelegama (2004a) and (2004b).

[4] Economic figures presented in this section are obtained from the CIA https://www.cia.gov/cia/publications/factbook/index.html, (2007/01/20), IMF country report 06/446, EDB export performance report 2004, Kelegama (2004a) and (2004b).

Sri Lanka began to shift away from a socialist orientation in 1977. Since then, the government has been deregulating, privatising, and opening the economy to international competition. Reform measures such as removing or relaxing entry barriers, outsourcing management, encouraging public-private partnerships, refining pricing strategies, establishing regulatory authorities and improving welfare targeting and reforming the civil service has had a positive impact on the economy (Kelegama, 2004a).

The manufacturing sector is the leading growth area and is dominated by the garment/apparel industry. Export performance of the garment/apparel industry amounted to US$ 419.42 million, an increase of 7.09% in 2004 over the previous year (EDB, 2004). (See Appendix C[5]). Sri Lanka's economy is highly dependent on the textile and garment industries, which accounts for 63% of exports (EDB, 2004). In 1970, plantation crops represented 93% of exports, which had reduced to 15% by 2003 (Kelegame, 2004b).

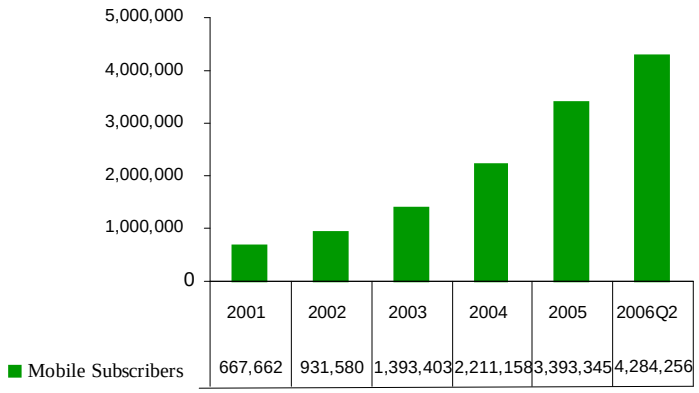
1.4.3 Telecommunication industry

The telecommunications sector is the most dynamic sub-sector, recording double-digit growth in 1998-2002. The Central Bank of Sri Lanka revealed that, in 2004, the telecommunications sector, in terms of subscriber network, expanded by 36%.The reforms introduced since the 1980s have made Sri Lanka's telecommunication sector one of the most liberal and fast growing sectors in the country. The country as a whole is benefiting from a domino effect created by the expansion of ICT. After Sri Lanka Telecom was privatised, it has performed effectively with performance indicators showing consecutive years of growth. The external gateway operators, which were the monopoly of Sri Lanka telecom (SLT), were opened for competition in 2003 with 32 licences being granted by the end of 2004. As a result, international direct dialling call charges decreased considerably, increasing the call volume. According to Central Bank sources, the mobile (cellular) telephone penetration in the telecommunications sector further increased to 73 per cent in 2005 from 71 per cent in 2004. Figure 1.4 presents

[5] Appendix C contains statistics compiled by the EDB on industry export performance for 2002 to 2004.

the growth in mobile subscriber numbers from 2001 to 2005 and forecast for the second quarter of 2006.

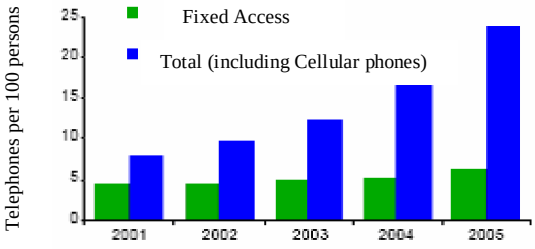
Figure 1.4 Sri Lanka's Mobile Market



Source: Sri Lanka Telecom Limited 2005

The national telephone density (telephones per 100 persons) for fixed access (wire lines) telephones increased from 5.1 to 6.3 per cent making the total telephone density including mobile phones to increase from 16.4 to 23.6 per cent in 2005. Figure 1.5 shows the total telephone density from 2001 to 2005.

Figure 1.5 Telephone Density in Sri Lanka



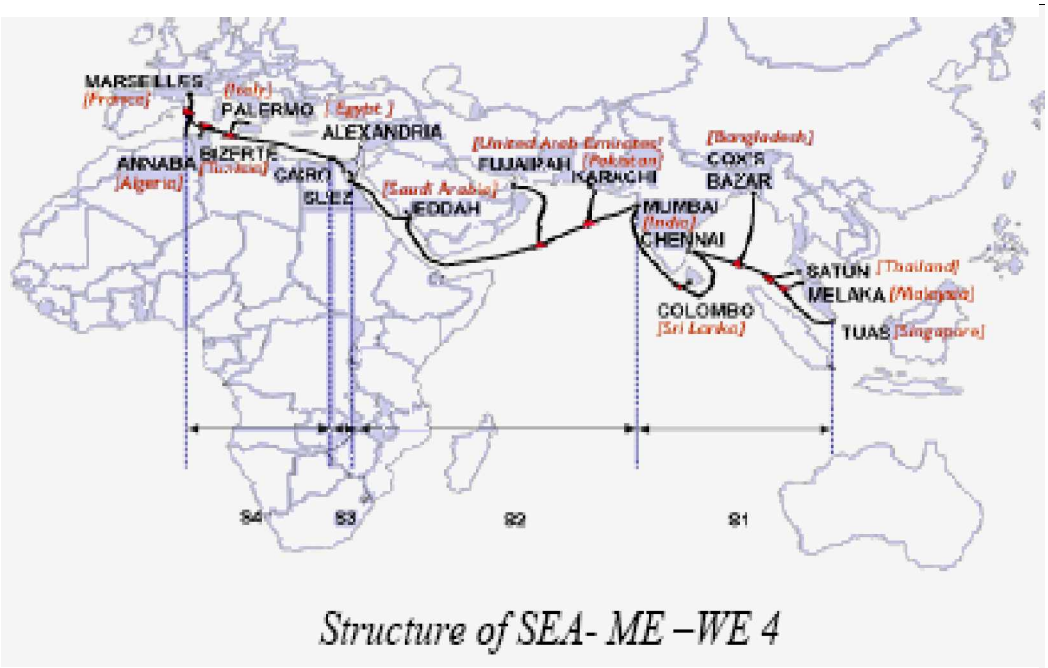
Source: Central Bank of Sri Lanka 2005

Out of the total fixed access telephones, 44% were in the Colombo metropolitan area at the end of 2004. With a view to enhancing telecommunication facilities in rural areas, the Telecommunication Regulatory Commission of Sri Lanka (TRCSL) is currently

working in rural areas to install payphones and providing CDMA (Code Division Multiple Access) technology.

A submarine cable between India and Sri Lanka was laid in 2005, securing fast telecommunication connectivity. The SEA-ME-WE-IV (South East Asia-Middle East-West Europe IV) submarine cable project, in which SLT is the local partner, was commissioned in 2005 with 15 other international partners. This enhances quality and provides greater bandwidth to improve communication services. Figure 1.6 depicts the submarine cable expanding from Marseilles in France to Tuas in Singapore.

Figure 1.6 Submarine cable



Source: Sri Lanka Telecom Limited 2006

1.4.4 Port services

The present government is proposing policies to take advantage of Sri Lanka's strategic location on shipping routes, to make use of the Indo-Lanka Free Trade Agreement, and to sign free trade agreements with other countries to achieve regional trading hub status. After three decades of improper management, the port services recorded a healthy growth in 2004 compared to previous years. A major reason for this is growth in

international trade. The total cargo handling, inclusive of container handling, grew by 10% in 2005, while the container throughput increased by 11%, to 2.5 million Twenty-foot Equivalent Container Units (TEUs) in 2005. The improvements are accredited to extension of working hours, nationalisation of the incentive payments, training of personnel and the implementation of a successful voluntary retirement scheme. The unit container terminal (UCT), built under the north pier development project, was opened for cargo handling in June 2004. As a result, the container handling capacity of the port of Colombo has increased by 250,000 TEUs per year. The number of ships arriving at Sri Lanka's ports increased by 7 per cent to 4,140 in 2005. Table 1.2 provides shipping details of Sri Lankan ports between 2004 and 2005.

Table 1.2 Performance of Port Services

Item		2004	2005(a)	Growth Rate	
				2004	2005(a)
1. Vessels arrived (No.)		3,883	4,140	-4	7
	Colombo	3,688	3,929	-4	7
	Galle	88	114	21	30
	Trincomalee	107	97	-12	-9
2. Total cargo handled		33,959	37,301	11	10
(Mt '000)	Colombo	31,299	34, 523	11	10
	Galle	578	655	20	13
	Trincomalee	2,082	2,123	14	2
3. Total container traffic (TEUs ' 000)		2,221	2,455	13	11
4. Transhipment container (TEUs '000)		1,531	1,717	12	12
5. Employment (no.) (b)		13,233	13,527	-5	2
	Colombo	11,888	12,217	-5	3
	Galle	634	622	-1	-2
	Trincomalee	7111	688	-8	-3

(a) Provisional (b) Only for Sri Lanka Ports Authority. TEUs = Twenty-foot equivalent container units
Source: Central Bank of Sri Lanka Annual Report – 2005

The development of the Colombo South Harbour, with deeper depths to serve mega ships carrying over 8,000-9,000 containers commenced in early 2006 with a plan for completion by 2009 when mega ships are expected to put in for servicing. Also, the Hambantota port is expected to develop as a bunkering centre, together with the Galle shipping port.

1.5 Structure of the thesis

There are eight chapters in this thesis: introduction, literature review, methodology, data analysis, three findings chapters and conclusions. The three findings chapters answer the research questions using the conceptual model, which contains three stages. Each of the findings chapters represents a stage in the conceptual model.

Chapter 1 has highlighted the area of study revealing insights from an exploratory study conducted at the early stages of the research. It provided contextual details in terms of Sri Lankan apparel industry policies and practices, economy, telecommunication and port services.

Chapter 2 contains three parts focused at defining the research aim and scope. The literature review informs the research questions. The themes of type of information sharing, level of information sharing, buyer supplier relations, and actual vs. perceived impact underpin the literature review. This chapter consists of the following sections:

Section One : SCM configuration, development and performance
Section Two : e-Business in SCM
Section Three: Information sharing

Chapter 3 establishes the suitability of the chosen methodology by describing the type of information required to answer the research questions. The discussion is based on key areas such as research philosophy, research strategy and data collection method.

Chapter 4 describes formulation and use of the Themes, Attributes and Categories (TAC) framework to analyse data. It describes the conceptual model and explains how it facilitates deeper levels of data analysis.

Chapter 5 discusses the analysis of the findings according to the first stage in the conceptual model. It compares the use of new types of ICT tools with previous methods in order to determine the advantages, disadvantages and the barriers from a manufacturer's internal perspective.

Chapter 6 presents discussion of the second stage of the conceptual model by revealing the involvement of external parties, such as the customer, in the decision to implement ICT tools capable of performing e-Business. It explains the practices of a supply chain in the context of a developed and a developing economy.

Chapter 7 provides information relating to the third and the final stage of the conceptual model. It takes a holistic view of the discussions, including those from the previous two chapters and evaluates the extent of e-Business usage by the participants. Furthermore, it examines the appropriateness of their expectations of e-Business in order to determine their attainability.

Chapter 8 restates the research aim and assesses how it was accomplished, using the conclusions derived from the empirical findings. Additionally, areas suitable for further research are recommended.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to undertake a critical review of the literature in the areas pertinent to the study's aim, in order to formulate suitable research questions. The literature search is based on four themes, which are reviewed to formulate the foundation for this research. At the start of the investigation, an exploratory study identified two themes suitable for academic inquiry: level of information sharing and buyer-supplier relationships. Further to the two themes identified from the exploratory study, two more themes, namely types of information sharing and actual vs. perceived impact, are used for the literature review, to meet the research aim. The discussion in this chapter is divided into three sections. The next table summarises the individual sections in this chapter according to the themes.

Table 2.1 Literature review Sections

Subject	Discussion	Themes
Section One	Introduction to SC and SCM. Definitions, concepts, evolution of practice, different theoretical perspectives and SCM performance	Buyer-supplier relations, type of information sharing and level of information sharing
Section Two	Introduction to e-Business scope, components, previous research and their limitations	Type of information sharing, level of information sharing, buyer supplier relations and actual vs. perceived impact
Section Three	Discussion of information sharing, previous research, limitations, starting point for this research	Type of information sharing, level of information sharing, buyer supplier relations and actual vs. perceived impact

The first section in the chapter examines literature linked to the themes of 'buyer-supplier relations', 'type of information sharing' and 'level of information sharing'. It creates a foundation for this thesis by reviewing journals from a variety of subject areas such as logistics, operations and production, marketing, human resources and management science. The concept of SCM is explored by evaluating definitions, concepts, and theories by authors such as Lee and Billington (1993), Bowersox and Closs (1996), Lambert and Stock (2001), Fawcett *et al* (2006), Harland *et al* (2006), and Waters (2006) in order to understand configuration, purpose and activities. A definition of SC and SCM suitable for this study is proposed. The evolution and current

developments of SC and SCM are discussed. Specifically, this section identifies the buyer-supplier relations evident in SCM and outlines the importance of the information flow. This section discusses performance indicators outlined by authors such as Hayes and Wheelwright (1984), Hill (1985), Krajewski and Ritzman (1993) and Slack *et al* (2001) to monitor and examine the link between performance improvement and information sharing.

Building on the three themes from the previous section, the second section, of this chapter includes another theme 'actual vs. perceived impact'. This section aims to identify the impact created by information communication technology (ICT), which can facilitate e-Business practices (McIvor and Humphreys, 2004 and Croom, 2005). The theme 'actual vs. perceived impact' discusses the hyperbole evident in e-Business and the type of technology used for communicating in SCM. ICT implementation is discussed by reviewing the evolution of e-Business in SCM. The perceived benefits of e-Business are identified based on authors such as Murillo (2001), Van Hoek (2001), Chaffey (2002), Quayle (2002), Turban and King (2003) and Power (2005a). The review of literature in this section reveals that there is a lack of empirical research to identify the true potential of e-Business (Cagliano *et al*, 2005).

The third section provides a discussion on managing the information flow through ICT tools such as Vendor Managed Inventory (VMI) and Collaborative Planning Forecasting and Replenishment (CPFR). This section discusses information sharing for SC coordination through reviewing 'push and pull' systems (Beach *et al*, 1998a and Slack *et al*, 2001) and the model by Swaminathan *et al* (1995). Previous research studies on information sharing in SCM and its limitations are identified to reveal gaps in current knowledge. In the final stage of the chapter, a research model is formulated amalgamating the four themes, which have acted as the foundation for the literature review.

Section One - SCM

2.2 What is Supply Chain Management?

2.2.1 Defining the Supply Chain

As a verb, supply means 'provide or meet what is needed: stock, store, amount etc…' (OED 1997); as a noun, supply means 'the act of filling a want or need' (Merriam-Webster, 1973 cited in Sherer, 2005). These definitions suggest that there is someone who determines the needs and wishes. This can refer to the end consumer. However, in the supply chain context, an internal entity may be the immediate consumer.

The term 'chain' usually refers to a flexible series, sequence or set of metal links or rings connected to or fitted into one another (Merriam-Webster, 1973). A chain typically implies linear, sequential relationships from one link to the next. The main limitation of using this definition is that goods and information flow concurrently and not always sequentially (Lee and Whang, 2001). At the time the term was coined, sequential information processing was the norm, due to information systems limitations (Power, 2005a).

The supply chain (SC) is the connected series of organisations concerned with different processes and value activities including planning and controlling of raw materials, components and finished products from suppliers to the final customer (Christopher *et al*, 2004). Porter (1985) explains that a SC is a set of independent firms jointly optimising their resources to take advantage of the market place. According to Chandra and Kumar (2000), a supply chain represents a supporting network of activities to transport raw material and finished goods to and from different geographic locations. The SC is the means for transforming the purchased raw material into intermediary and finished products and distributing them to the end consumer (Lee and Billington, 1993 and Lambert and Stock, 2001). Many definitions of supply chain have been proposed. These definitions vary according to the people involved, processes and goals comprised in the definition. Appendix D illustrates three of these definitions analysed according to entities, activities and purpose.

After reviewing the definitions (See Appendix D), it was identified that none of these definitions provided a suitable platform upon which to base this research. The main reasons for not choosing these definitions are as follows:

1). Key words[6] relevant to this research are spread across all three definitions (One definition does not contain all the key words as the goals and objectives are different). For example (from Appendix D) the SC purpose stated by Christopher (1998) is focused on 'creating value from different processes and activities', whilst Lee and Billington (1993) suggest the purpose is 'logistical problem solving' and Lambert and Stock (2001) argue 'bringing products and services to the market' as the main purpose of SCM.

2). Some key words are shared by certain definitions and ignored by others. For example, 'network' is mentioned by Lee and Billington (1993) and Christopher (1998) but not by Lambert and Stock (2001). However, 'delivering products and services to the consumer' is stated by Christopher (1998), and Lambert and Stock (2001) but not by Lee and Billington (1993).

3). Some key words are not mentioned in any of the above definitions. For example, the international perspective is not mentioned in any of the above definitions. The international dimension [has been noted] by authors such as: Akkermans *et al* (1999), Harland *et al* (1999), Meijboom (1999), and Ettlie and Sethuraman (2002), and is important in this PhD research.

The researcher will construct his own definition later in this chapter (in Section 2.2.4) to overcome these problems. The definitions above suggest similarities as well as noticeable variations in the configuration of the supply chain. Different industry perspectives, subject perspectives and desired outcomes may cause these variations.

For example, Martin Christopher is a Professor of marketing and logistics at Cranfield University. His views on SC are from a marketing perspective, promoting competitiveness as the priority. The competitiveness of SCs is emphasised by that part of the definition, which begins: *In the hand of the ultimate customer*

According to Lee and Billington (1993), there are three types of flows in a supply chain. They are information flow, product flow and financial flow. Christopher (1998) does not clearly refer to the three flows, but provides an indication of a 'movement' by using

[6] The key words were identified according to the themes. The key words are listed in appendix E.

the phase *through upstream and downstream linkages.* Lee and Billington (1993) clearly note the importance of the three flows in their definition. This is evident in that part of the definition of SC where they state:

> *It is about managing co-ordinated information, material, and financial flows*[7]
>
> (Lee and Billington, 1993:386).

The Institute of Logistics and Transport (ILT) (1998) suggests that these three flows have a direct impact on the configuration (entities, activities and purpose) of a supply chain. Examples of the three flows are listed in Table 2.2

Table 2.2 Three main flows of supply chain management

Type of Flow	**Examples**
Information flow	Forecasts, order transmission and delivery status reports
Product flows	Movement of products from suppliers to customers and reverse flows via product returns, servicing, recycling and disposal
Financial flows	Credit card information, credit terms, payment schedules, consignment and title ownership arrangements

Adapted from: Institute of Logistics and Transport (1998), Glossary of Inventory and Materials Management Definitions, p 10

Lancioni *et al* (2000) suggest that the development of supply chains over the years has been slow. Similarly, Christopher (1998) argues that the SC evolved as firms added various activities to their distribution function to remain competitive rather than emerging as a specifically designed function to suit the whole organisation (Lambert and Stock, 2001).

Christopher (1998) also suggests that the SCs that have developed create difficulties and complexities for management, as newly added activities will not integrate with existing processes. Christopher further suggests that there is a danger that newly added activities might hamper the effectiveness of existing processes. By discarding existing SCs and designing custom-made 'flatter' or 'horizontal' SCs, it has been argued that firms will

[7] The materials flow refers to both raw materials and finished goods.

improve integration and reduce cost by eliminating unnecessary processes (Womack *et al,* 1990 and Slack, 1992).

Some companies developed their SC, beginning first with the transportation component and then evolving to include warehousing, purchasing and raw materials inventory, materials handling, finished goods inventory, packaging, and customer service (Bowersox and Closs, 1996 and Lancioni *et al,* 2000). It has been suggested that the SC will be extended further to incorporate more activities that increase competitiveness with higher customer expectations (Lysons, 2000). However, according to Poirier and Bauer (2001), future supply chains will not compete on added activities but on better service such as custom-made products and faster response time. The use of information technology has created the opportunity for closer relationships between the end user and the manufacturer (Van Hoek, 2001).

2.2.2 Defining Supply Chain Management

The strategic importance of supply chain management is underscored by the observations of John Gossman, vice president of materials management at AlliedSignal:

> *Competition is no longer company to company, but supply chain to supply chain*
> (Gossman, 1997).

The term 'management' is defined as 'the act or acts of managing control, direction; judicious use of a means to accomplish as ends' (Merriam-Webster, 1973). Management refers to the process of getting activities completed efficiently, effectively with and through people. It includes the functions of planning, organising, leading, and controlling (Slack *et al,* 2001).

Recent developments in SCM suggest that firms are allocating large investments to develop their SCs (McIvor and Humphreys, 2004 and Closs *et al,* 2005). An indication of the growing impact of Supply Chain Management (SCM) is its appearance in the title of leading textbooks and in the sub-disciplines of purchasing (Monczka *et al,* 1998 and Lysons and Gillingham, 2003) and logistics (Christopher, 1998).

Vertical integration was a strategy used by large automobile companies, like Ford, who

buy other members in the channel to gain superior competitiveness over rival players (Johnson and Scholes, 1999). The popularity of vertical integration ended with overexpansion problems, resource exhaustion and high maintenance costs (Christopher, 1998). The emergence of SCM as a channel coordinator avoided management difficulties and high running costs whilst providing the benefit of a vertically integrated channel (Williams *et al*, 2002). According to Akkermans *et al* (1999), SCM is commonly used across industries to enable the integration of business operations. However, the increasing use of the SCM acronym does not mean that there is consensus on its precise definition (Harland *et al*, 1999 and Larson and Halldorsson, 2002).

Although SCM has gained approval from managers and has captured the interest of many scholars, knowledge of this topic is still emerging (Choi and Rungtusanatham, 1999; Folinas *et al*, 2004; Mills *et al*, 2004 and Waters, 2006). Much of what we know about SCM has been based on case records of a few leading-edge companies such as Toyota (Womack *et al*, 1990 and Fruin, 1992) and Volvo (Kinch, 1992). Bresnen (1996) and Popp (2000) argued that most of the research in SCM has been narrowly focused on specific industries such as the automobile industry, and that the results of this work may not necessarily translate to other sectors where the operating environments are different. Research on non-automobile companies includes Hewlett-Packard (Lee and Billington, 1992 and 1993; Davis, 1993 and Billington, 1994), Apple Computers (Jarillo, 1993) and McDonald's (Jarillo, 1993). According to Choi and Rungtusanatham (1999), only a few empirical studies have been done to compare management practices across the supply chain. Beach *et al* (1998a) outline the difficulties of researching SCM:

> *Gathering data on the performance of a single channel member is often difficult enough. Gathering data for the multiple channel members (raw materials suppliers through retailers) that operate as a single supply chain is prohibitively difficult due to limited access to the data and poor quality in that data when it is accessible* (Beach *et al,* 1998a:23).

Outlining the difficulty of understanding SCM practice, Harland *et al* (1999) claim that while the body of knowledge has been evolving quickly, the rates of evolution in SCM practices have been even quicker. They further claim that decisions taken in high performing supply networks have not been driven by management theory but by

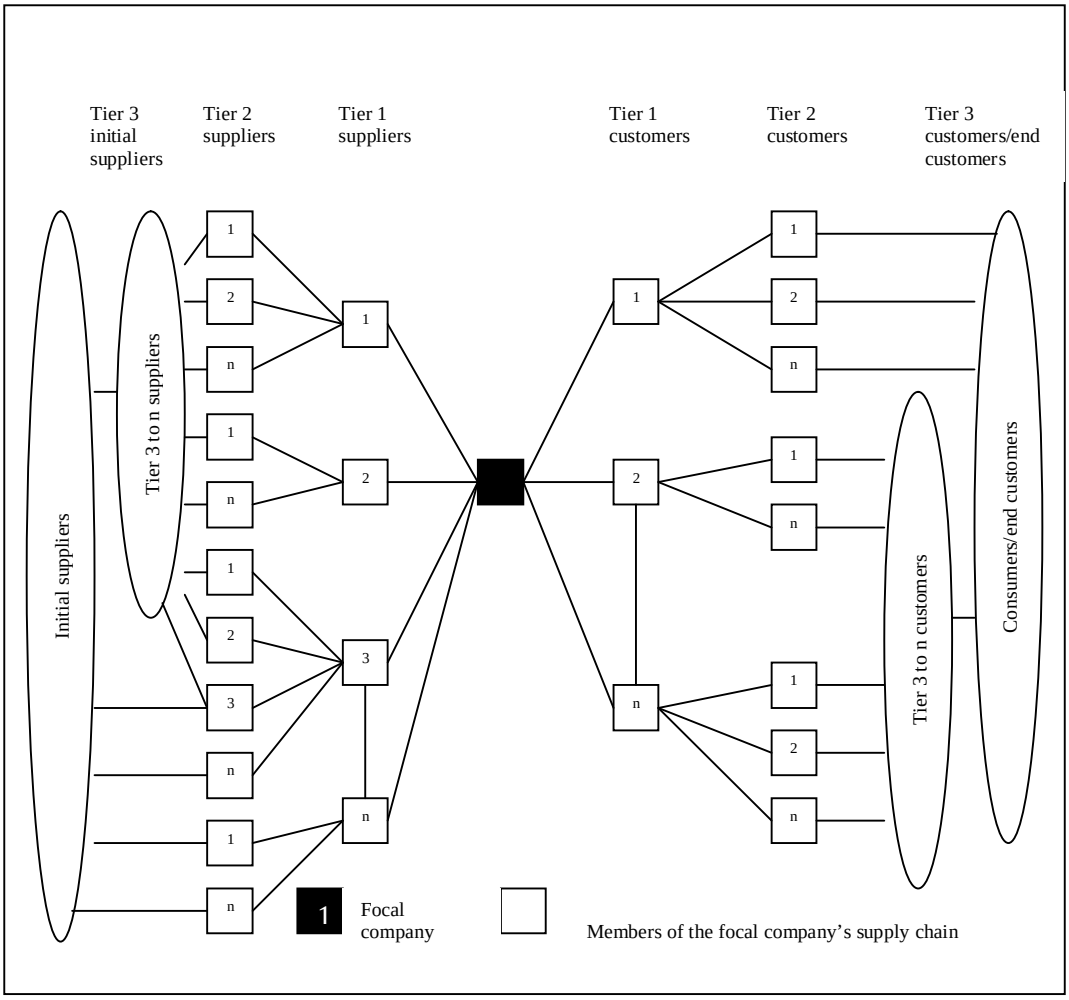
experience.

According to Mills *et al* (2004) SCM can be viewed according to four perspectives:

1. Upstream perspective: as purchasers, dealing with suppliers
2. Downstream perspective: as suppliers, dealing with customers
3. Static network: auditor of its position in its supply network, typically comprising several supply chains. This perspective provides a static and comparative view.
4. Dynamic network: strategist, seeking opportunities to improve the firm's position in an existing network or even creating a new network. This perspective provides a strategic, dynamic and long-term view.

In the upstream perspective, two important areas are the structure of the supply base and the links between the buyer and supplier (Christopher *et al*, 2004). This perspective attempts to combine the three topics involved in Swaminathan *et al's* (1995) research (i.e. supply chain configuration, buyer-supplier relations and buyer supplier coordination). The downstream perspective takes a supplier's perspective. This covers logistics issues such as replenishment strategies and forecasting systems (Fisher *et al*, 2001 and Smäros *et al*, 2003). The strategic network perspective discussed by Mills *et al* (2004) views a focal firm's whole supply network. According to Lambert *et al* (1998) the supply chain network structure will have a different look depending on who is the focal company, that is, the company whose management is mapping the supply chain. Figure 2.1 depicts the supply chain structure according to the focal company. This perspective appears to agree with the concepts of the value chain because it discusses a firm's position in respect of its relationship with its supplier, channel and buyer (Porter, 1985).

Figure 2.1 Supply chain network structure



Source: Lambert *et al* (1998: 3)

Lambert *et al* (1998) suggest that every firm views itself as the focal company, thus the perceived supply chain network structure is arbitrary. Lambert *et al* (2001) provide an explanation regarding the management components of SCM, in that they claim there are two groups: the first group includes most visible, tangible, measurable, and easy to change components. They say that the second group contains managerial and behavioural components which are less tangible, visible and often difficult to assess and change. Table 2.3 presents the two groups.

Table 2.3 The management components of SCM

Physical and technical	**Managerial and behavioural**
Planning and control methods	Management methods
Work flow/ activity structure	Power and leadership structure
Organisation structure	Risk and reward structure
Communication and information flow facility structure	Culture and attitude
Product flow facility structure	

Source: Lambert and Stock (2001:78)

Lambert *et al* (2001) claim that managers generally do not understand managerial and behavioural components and encounter difficulties with them. This research attempts to understand the power and leadership structure mentioned on the right side of the table. On this issue, Lambert and Stock (2001) argue that:

> *Power and leadership structure across the supply chain will affect its form. One strong leader will drive the direction of the supply chain. In most supply chain studies to date, there are one or two strong leaders among the firms. The exercise or the lack of power can affect the level of commitment of other supply chain members. Forced participation will encourage exit behaviour, given the opportunity* (Lambert and Stock, 2001:77).

The dynamic perspective discussed by Mills *et al* (2004) is concerned with the strategic long term evolution of supply networks. They claim that the evolution of supply networks occurs in terms of consolidation by merger or acquisition with other members in mature and declining markets, and increased outsourcing in rapidly growing markets. The focus in the present study is not restricted to any particular perspective discussed by Mills *et al* (2004) but rather contains elements that may refer to each of the perspectives they propose. This is because this research takes the manufacturer's view in servicing the retailer, which would involve both upstream and downstream processes. Essentially, this study considers the information sharing and relationship aspects, from a strategic perspective. The data from the exploratory study indicates that the apparel SC is somewhat different from the SC reviewed by Mills *et al* (2004). This is because in the apparel SC the retailer is participating in both upstream and downstream activities (Guercini and Runfola, 2004). According to Popp (2000), Guercini and Runfola (2004) and Taplin (2006) the apparel SC is different from SCs in other industries such as

automobiles because of emerging alliances and joint ventures between the manufactures and the retailer. Therefore it can be argued that Mills *et al*'s (2004) research may not provide an adequate explanation of the apparel SC. The different perspectives, in terms of subject and industry, have resulted in variations of SCM definitions (Croom *et al,* 2000 and Cigolini *et al,* 2004). Appendix E presents two of these definitions analysed according to entities, activities and purpose.

The purpose of analysing the above definitions is twofold: firstly to understand different perspectives proposed by authors, and secondly to establish a definition for this research. The definitions were chosen as examples from the available literature and are cited in other publications such as Beach *et al* (1998b). It was established, however, that the above definitions do not provide a suitable platform on which to base this research because:

1). Some key words are not stated in a single definition. For example 'integration of key business processes for coordination' is outlined by Lambert and Stock (2001), the importance of 'relationships with suppliers' is outlined by Christopher (1998) and the Supply Chain Council appears to provide only a broad definition, underscoring activities by stating the 'effort involved'. However, the Supply Chain Council provides a supply chain operations reference (SCOR) model for benchmarking supply chain processes and designing IT solutions for SCM[8].

2). Some key phrases such as 'delivering value added products to customers' are outlined by Lambert and Stock (2001) and Christopher (1998). It appears that these authors agree on some points but differ in others.

3). Several important words such as 'strategy' (Gossman, 1997; Harland *et al,* 1999; Slack *et al,* 2001; Stephens and Wright, 2002; Tan *et al,* 2002; Cousins and Crone, 2003 and Mills *et al,* 2004), 'performance improvement' (Beach *et al,* 1998a; Akkermans *et*

[8] In the SCOR model companies take both an intra-organisational and inter-organisational perspective regarding sourcing, making and delivering from supplier's supplier to the customer's customer.

al, 1999; Beach *et al,* 1999; Choi and Rungtusanatham, 1999; Vickery *et al*, 1999; Slack *et al,* 2001; Ettlie and Sethuraman, 2002; Fynes and Voss, 2002; Macbeth, 2002; Tan *et al*, 2002 and Colotla *et al*, 2003) and 'developing-buyer supplier relations' (Sako, 1992; Swaminathan *et al,* 1995; Leonidou and Kaleka, 1998; Hakansson and Gadde, 2001 and Fynes and Voss, 2002) are not mentioned in these definitions. As previously mentioned, the researcher will propose his own definition later in the chapter to overcome this problem (See section 2.2.4).

Compared to Christopher's (1998), the definition by Lambert and Stock (2001) clearly outlines the importance of information integration, which is a vital part of SCM (Scott and Westbrook, 1991; Byrne and Javad, 1992; Daugherty, 1994; Gustin *et al,* 1994 and Bowersox and Closs, 1996). As mentioned previously, Christopher focuses more on market competitiveness, while Lambert and Stock (2001) focus more on the *integration* within the supply chain. Mentzer *et al* (2001) argue that there is theoretical ambiguity regarding the origin of SCM. Larson and Halldorsson (2002) explain that SCM covers a multitude of management disciplines, and understanding the exact scope of SCM is extremely difficult. Accordingly, Larson and Halldorsson (2002) argue that:

> *Supply chain management remains a topic of considerable interest among supply practitioners and academicians. Academic journals are being created or renamed; business schools are offering SCM programs; professors are altering their titles and research interests. This flurry of activity, across multiple business disciplines, makes the scope of SCM unclear…*
>
> (Larson and Halldorsson, 2002:36).

It appears that Larson and Halldorsson's *(2002)* review is based on the purchasing literature, whilst Svensson (2002a) proposed a SCM definition based on the theory of marketing. The complexity involving different SCM processes (i.e. complex networks, product structures, distance, organisational barriers) hamper achieving a clear picture of SCM practice (Meijboom, 1999; Macbeth, 2002; Guercini and Runfola, 2004; Burgess *et al,* 2006). According to Beach *et al* (1998a) demand uncertainty (Christopher *et al,* 2004 and Lowson, 2005) and external influences such as trade disputes, government interventions (Colotla *et al,* 2003) also complicate the SCM process, making it difficult to understand. The inclusion of the international dimension (Ferdows, 1997) further complicates SCM practice (Chakravarty *et al,* 1997; Tayur *et al,* 1998; Popp 2000;

Ettlie and Sethuraman, 2002 and Guercini and Runfola, 2004). Maijboom (1999) and Christopher *et al* (2004) suggest that products previously manufactured in a single location are now produced in a complex network (Caputo *et al*, 2005) of facilities separated by thousands of miles. Therefore the international dimension (Christopher *et al*, 2004) appears to be an important aspect that warrants inclusion in a discussion of SCM.

Despite the variations, Akkermans *et al* (1999) suggest that there are common characteristics in different SCM definitions:

- SCM involves multiple echelons, processes and functions such as suppliers, purchasing, manufacturing, distribution, marketing/sales, and customers (Croom *et al*, 2000; Lambert and Stock, 2001 and Mouritsen *et al*, 2003).

- Clear focus on co-ordination and/or integration (Fawcett and Magnan, 2002; Caputo *et al*, 2005; Cagliano *et al*, 2006 and Gulledge, 2006).

- Main aim of SCM is to achieve a simultaneous increase in customer service and profitability (Christopher *et al*, 2004 and Lowson, 2005).

Authors such as Coyle *et al* (1996), Gottorna and Waters (1996), Poitier (1999), Copacino (1997) and Waters (2006) note that supply chain management is responsible for all the physical movement of materials. This includes upstream (Christopher, 1998 and Mills *et al*, 2004) movement into the process from suppliers, through operations, and then downstream (Jaana and Timo, 2005) out of the process to customers. As a whole, SCM focuses on the integrated planning, co-ordination and control (Tan *et al*, 2002 and Croom, 2005) of all logistical business processes and activities in the supply chain (Mentzer *et al*, 2004) to deliver superior customer service (Christopher, 1998) at less cost to the chain as a whole (Swaminathan *et al*, 1995 and Cousins, 2005), whilst satisfying the requirements of other stakeholders, such as consumer interest organisations and government (Pires *et al*, 2001 and Van der Vorst *et al*, 2002).

According to Swaminathan *et al* (1995) the concept of SCM can be described by subdividing into three interrelated topics. These topics are supply chain configuration (SCC), buyer-supplier relations (BSR), and buyer-supplier coordination (BSC). These

three areas are presented in detail in Table 2.4.

Table 2.4 Concept of SCM subdivided in to three topics

Supply Chain Configuration (SCC)	SCC determines an optimal number of suppliers and selects specific suppliers (internal and external) based on considerations including quality, lead times, costs, reliability, expected learning curves, locations, capabilities and earlier experiences.
Buyer-Supplier Relations (BSR)	BSR assesses the merits of alternative contracts and agreements between buyers and suppliers. BSR includes understanding trade-offs involved in setting up cost-sharing agreements, determining the length of contracts, agreeing to share different types of information (e.g. open-book audit of suppliers) and committing to buying a percentage of the supplier's capacity.
Buyer-Supplier Coordination (BSC)	BSC is concerned with identifying efficient coordination policies to maintain a smooth flow of material and product through the supply chain, avoiding stockouts whilst keeping inventories as low as possible. Decisions of interest at this level include the selection of proper inventory policies and associated reordering policies (how much to order and when) as well as evaluating the impact of different information exchange protocols.

Adapted from: Swaminathan *et al* (1995:2)

SCC covers supplier policy and selection (Zsidisin and Ellram, 2001 and Pidduck, 2006). The supplier selection criteria mentioned under SCC are discussed under performance objectives (Hayes and Wheelwright, 1984; Slack *et al*, 2001; Staughton and Johnstons, 2005 and Silveria and Cagliano, 2006). The topics BSR and BSC are also related to the field of current research. BSR (Christopher and Jüttner, 2000; Peck and Jüttner, 2000; Humphreys *et al*, 2001; Zsidisin and Ellram, 2001; Svensson, 2002b; Williams *et al*, 2002; Cox *et al*, 2004; Duffy and Fearne, 2004; Fynes *et al*, 2005; Hadjikhani and Thilenius, 2005; Szwejczewski *et al*, 2005 and Souviron and Harrison, 2006) is concerned with level of information sharing and types of information sharing important for collaboration (Hoyt and Huq, 2000; Horvath, 2001; Holmström *et al*, 2002; Simatupang and Sridharan, 2002; Larsen *et al*, 2003; Smäros, 2003; Barratt,

2004; Tuominen, 2004; Bonet and Paché, 2005; Simatupang and Sridharan, 2005; Todeva and Konke, 2005; Sheu *et al*, 2006 and Wilding and Humphries, 2006) and is a main focus of this research. The relationship between BSR and information sharing (Shore and Venkatachalam, 2003; Closs *et al*, 2005 and Sheu *et al*, 2006) covers three of the themes involved with this research: role of the lead-firm (Cooper *et al*, 1997b; Williams *et al*, 2002; Cox *et al*, 2004; Guercini and Runfola, 2004; Iyer *et al*, 2004; Croom, 2005; Todeva and Konke, 2005; Fawcett *et al*, 2006 and Moedas, 2006), type of information sharing and level of information sharing (Lau and Lee, 2000; Moberg *et al*, 2002; Shore and Venkatachalam, 2003; Adewole, 2005 and Li *et al* 2005). BSC covers the coordination (Zhao *et al*, 2002 and Simatupang *et al*, 2004) in the SC that is vital for inventory management (Lee and Whang, 2001 and Disney and Towill, 2003). BSC also covers the impact of different information exchange protocols (Shore and Venkatachalam, 2003 and Closs *et al*, 2005) on inventory management (Lee and Whang, 2001; Disney and Towill, 2003; Smäros *et al*, 2003; and Dorling *et al*, 2006).

Samaranayake (2005) links the areas of SCC, BSC and BSR. He argues that the basis of an effective SC structure is based on the relationship between the entities (Christopher *et al*, 2004 and Taplin, 2006) or actors (Hadjikhani and Thilenius, 2005). Samaranayake (2005) focuses on SC structural aspects important for achieving integration (Forza *et al*, 2000 and Gulledge, 2006) and argues that lack of strong relationships hampers the integration between the entities (Fawcett and Magnan, 2002; Power, 2005b and Modes, 2006) which creates a barrier for achieving visibility (Smäros *et al*, 2003 and Fawcett *et al*, 2006). According to Samaranayake (2005) research on structural changes created by information sharing practices is still at the initial stages (Iyer *et al*, 2004). According to Popp (2000) institutional structure is an important but neglected area of SC practices (Fawcett *et al*, 2006 and Willianms *et al*, 2002). Popp (2000) states that:

> *It seems vital that the issue of institutional structure both be brought to greater prominence in SC studies and put on a firmer theoretical footing.*
>
> (Popp, 2000:160)

According to Popp (2000), current literature discussing SC intermediaries and dependencies is inadequate to explain the organisational forms occurring in the apparel sector (Bruce *et al*, 2004; Christopher *et al*, 2004; Guercini and Runfola, 2004;

Simatupang *et al*, 2004; Moedas, 2006 andTaplin, 2006). Popp (2000) claims that:

> *Considerable empirical work may be necessary to develop a clearer understanding of the information flows characteristic of the varied organisational forms, such as acquisitions, joint ventures and third party sourcing through which international trade in clothing is conducted.*
>
> (Popp, 2000:156)

This is important because the largest proportion of the clothing consumed in the UK is manufactured overseas (Lowson, 2001; Christopher *et al*, 2004 and Taplin, 2006). It appears that new forms of SC are emerging in the apparel industry between the overseas manufacturer and the UK retailer (Birtwistle *et al*, 2003; Guercini and Runfola, 2004 and Moedas, 2006) because of additional entities such as intermediaries to control the information flow. For example, research by Popp (2000) claims that an additional entity in the SC has added value by creating smooth operations between the manufacturer and the retailer, disproving the previous assumption that such a scenario would reduce value. It could be argued that if information sharing between the manufacturer and the retailer is exercised as required it would be possible to eliminate the intervening third party.

It appears that the topics of SCC, BSR and BSC have strong links to information sharing. Based on the studies cited above it can be argued that SCC is a key factor for achieving and developing BSR and when BSR improves, BSC also improves because the information exchange required for BSC will be more accessible as this would increase trust (Hadjikhani and Thilenius, 2005).

2.2.3 Origins of Supply Chain Management

The previous sections defined SC and SCM, and outlined that the main differentiating factor of SCM is that it makes the flow of products and information between firms a strategic matter (Peck and Jüttner, 2000; Towill and Christopher, 2002 and Todeva and Konke, 2005). According to Mouritsen *et al* (2003) the existing definitions of SC and SCM are not conclusive because they vary (Mentzer *et al*, 2001; Larson and Halldorsson, 2002 and Storey *et al*, 2006) and are also largely silent on the matter of origin. SCM is a recent phenomenon and yet it is clearly related to logistics (Closs *et al*,

2005). Storey *et al* (2006) argue that SCM is both an emergent field of practice (Pires *et al*, 2001) and an emerging academic domain (Harland *et al*, 2006).

The origins of SCM are discussed from different functional perspectives such as purchasing and supply, logistics and transport, industrial organisation, marketing, strategic management, and many others (Burgess *et al*, 2006 and Croom *et al*, 2000). For example, Lysons and Gillingham (2003) and Larson and Halldorsson (2002) argue that SCM originated as an extension to the purchasing function. According to the chief executive officer of the Institute of Supply Management (ISM), Paul Novak, the supply chain derived from the extended role of purchasing. Novak (1999) argued:

> *Purchasing, or more accurately, supply chain management, can and should play a vital role in managing the supply chain process as it pertains to suppliers.*
>
> (Quoted by Larson and Halldorsson, 2002:37)

Before the 1980s, most organisations worked almost independently of their suppliers. Purchasing managers rarely viewed suppliers as value-added partners. According to Sherer (2005), in 1992 the Efficient-Consumer-Response (ECR) Working Group developed a set of best practices that led to continuous replenishment inventory. Point of purchase transaction details were sent to the manufacturers so that they could keep the retailer replenished and balanced. Vendor Managed Inventory (VMI) works on the same principle (Disney and Towill, 2003). Authors such as Monczka *et al* (1998) propose that purchasing is the core function of SCM and managing the supplier's supplier is often referred to as supply chain management. Leenders and Fearon (1997) suggested that SCM is often used to refer to the purchasing department's efforts to develop better, more responsive suppliers.

According to Christopher (1998), Svensson (2002a) and Mentzer *et al* (2004) the marketing function acted as the base for creating SCM. This view is based on responding to competition from rival supply channels and servicing the end consumer. Lambert and Stock (2001) suggest an evolutionary process from physical distribution management (PDM) to logistics, and from supply chain to supply chain management (SCM).

Economic pressures in the 1950s caused firms to focus on all their operating costs (e.g.

ordering costs and holding costs), including the largely unexplored area of distribution (Stacy and Wilson, 1958 and Drucker, 1962). In the early 1960s Drucker described logistics as 'the economy's dark continent'. Based on military applications (Johnson and Wood, 1996) and organisational theories (e.g. Forrester, 1961), the concept of physical distribution management (PDM) emerged. The boundaries of PDM were subsequently extended to incorporate materials management, opening up the field of 'business logistics' (Gattorna, 1990; Bowersox and Closs, 1996 and Christopher, 1998). In the last two decades, these boundaries were extended further to embrace information flows, a process evident in supply chain management (Harland, 1996; Cooper *et al*, 1997b; Cigolini *et al*, 2004 and Waters, 2006). It is further suggested that the evolutionary process continues with other developments such as the debate on the structure of the supply chain, i.e., 'hierarchical vs. network' (Baden-Fuller and Lorenzoni, 1995; Harland, 1999; Kogut, 2000; Lambert and Stock, 2001; Kemppainen and Vepsäläinen, 2003; Lysons and Gillingham, 2003; Häkansson and Person, 2004 and Mills *et al*, 2004).

2.2.3.1. Evolution of Supply Chain Management - A theoretical perspective

The latest structural form of SC appears to be a supply network of entities. Mills *et al* (2004) argue that involvement of multiple chains have formed the term 'network' and it adds a more strategic focus as it demands managing different sets of entities. According to Lamming *et al* (2000) there are two distinct areas of research concerning supply networks:

- Mostly descriptive research on industrial networks observed from a marketing and purchasing view.

- More prescriptive research on supply chain management, observed from strategic management, operations and logistics.

The present study is focused on the second area according to the field of operations management. The evolutionary theory of SCM suggests that PDM was the starting point for SCM (Stephens and Wright, 2002). PDM relates to downstream (Jaana and Timo, 2005) or the *output* phase of moving finished goods from production departments (Humphreys *et al*, 2001 and Slack *et al*, 2001) to retail units (Lowson, 2005) and then

through the appropriate channels of distribution to the end consumer (Lysons and Gillingham, 2003 and Christopher *et al*, 2004). Materials management (MM) at the *input* phase is concerned with moving items such as raw materials and components from the suppliers to production (Colotla *et al*, 2003). MM applies to upstream activities (Lambert and Stock, 2001) in the supply chain and PDM is concerned with downstream activities (Christopher, 1998 and Silveira, 2003).

Conventional wisdom tends to view the terms 'physical distribution', 'logistics' and 'supply chain management' as interchangeable and almost synonymous (Lambert and Stock, 2001:2 and Waters, 2006:398). According to Stephens and Wright (2002) and Cigolini *et al* (2004) the three terms are neither synonymous nor interchangeable. As Sparks (1999) points out, physical distribution is somewhat narrower than logistics. The co-ordination, control and customer service of logistics is the main difference between logistics and PDM (Slack *et al*, 2001:415). Arguing the difference between logistics and supply chain management, Cooper *et al* (1997a) identified ten components exclusive to SCM. These components are illustrated in Table 2.5. Cooper *et al* (1997a) claim that the scope of logistics is narrower than SCM and that logistics can be viewed as an activity or a function, whereas SCM is a strategic tool used to intersect boundaries and focus on relationships (Mouritsen *et al*, 2003). In this section, whilst arguing for the evolutionary theory, similarities and differences between PDM, logistics and SCM will be discussed.

Table 2.5 Components of Supply Chain Management

Differentiating components between SCM and Logistics	Planning Work structure Organisation structure Product flow facility structure Information flow facility structure Product structure Management method Power and leadership structure Risk and reward structure Culture and attitude

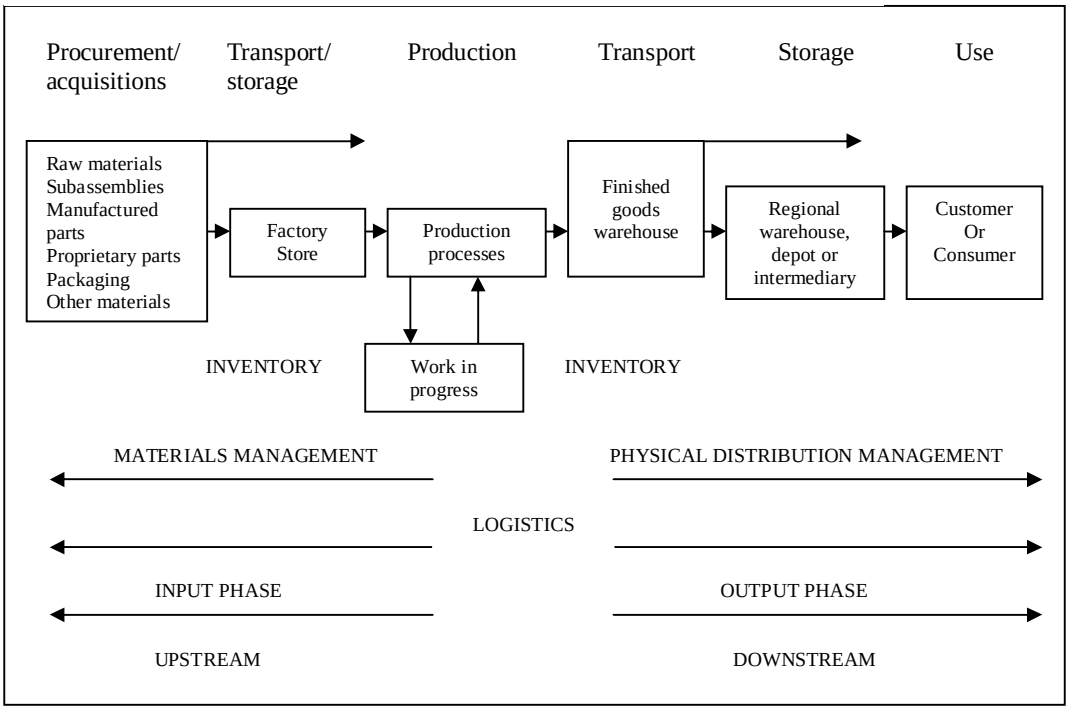
Adapted from: Cooper *et al* (1997a:10)

Logistics comprises of MM and PDM (Slack *et al*, 1998), and can be divided into military logistics and non-military logistics or 'business logistics' (Johnson and Wood, 1996). Figure 2.2 depicts the relationship between MM, PDM and logistics. Military

logistics and business logistics share the same principles apart from the fact that military logistics deals with more complex applications (Lysons and Gillingham, 2003). Non-military logistics or business logistics can be defined by the following two definitions:

> *Logistics is that part of the supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services and related information from the point of origin to the point of consumption in order to meet the customers' requirements* (Council of Logistics Management, 2002).

Figure 2.2 Scope of Logistics Management



Source: adapted from Gattorna (1986)

Alternatively:

> *Logistics is the process of planning, implementing and controlling the efficient and effective flow and storage of goods, services and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements* (Bowersox and Closs, 1996:4).

The above definitions illustrate the breadth of the logistics function. The traditional

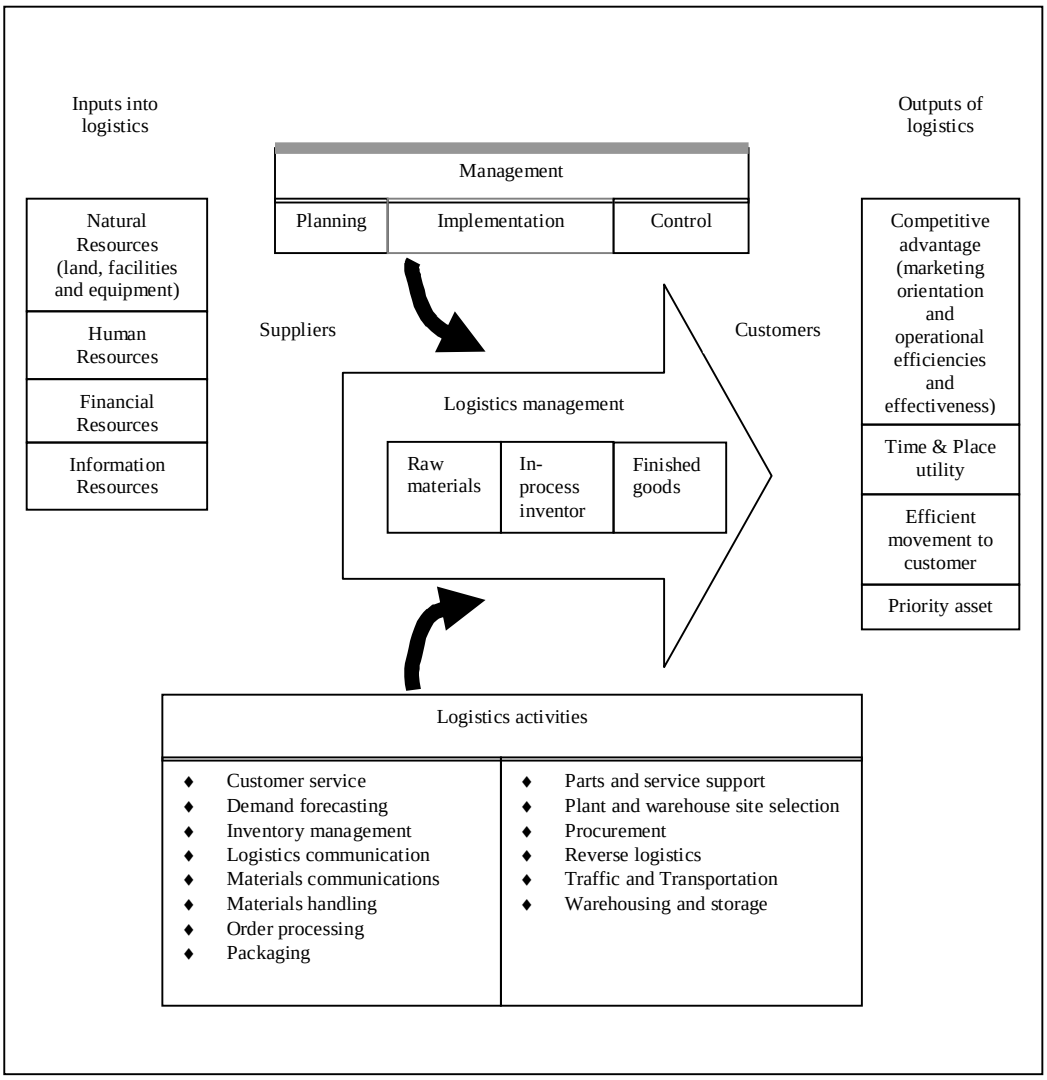
areas of transportation and warehousing are recognised and accepted as being the responsibility of logistics managers, but these increasingly represent only a part of the role (Aldin *et al*, 2003; Wanke and Zinn, 2004; Mentzer *et al*, 2004 and Nilsson, 2006). Shapiro and Haskett (1985) argue that 'there are few aspects of human activity that do not ultimately depend on the flow of goods from point of origin to point of consumption'. Without logistics, no materials move, no operations are done, no products are delivered, and no customers are served (Gammelgaard, 2001 and Waters, 2006). See Figure 2.3 for diagrammatic illustration of Logistics Management.

Integrated logistics also include inventory management, inbound logistics, and after sales logistics, which are aimed at achieving the required services at the least total cost (Aldin *et al*, 2003). Added to this is the role of logistics in contributing to 'form' utility, e.g. breaking up bulk and repackaging, enhancing the augmented product aspects, adding value and supporting a differentiation strategy. Porter (1985) provides an example of the benefit of 'form utility' stating that:

> *By agreeing to deliver bulk chocolate to a confectionary producer in tank cars instead of solid bars an industrial chocolate firm saves the cost of moulding and packaging while the confectionary manufacturer lowers the cost of in-bound handling and melting* (Porter, 1985:51).

These additional functions illustrate the breadth of a logistics manager's responsibility (Christopher, 1992; Daugherty *et al*, 1992; Lambert and Stock, 2001 and Mongan and Christopher, 2005). Mills *et al* (2004) agree with the views of Bowersox and Closs (1996) that SCM is purely concerned with the external logistics integration of customers and suppliers. They claim that literature on logistics presumed rational co-operation between the entities involved and, based on this presupposition, strove to find solutions for inventory, transportation and information flow (Wanke and Zinn, 2004). The literature on SCM is distinguishable from logistics because SCM literature considered behavioural and political dimensions of trust and power, conflict and dependence between supplier and buyer (Svensson, 2002b; Cigolini *et al*, 2006 and Fawcett *et al*, 2006). It appears that logistics research focused on reducing total cost (Christopher *et al*, 2004), while SCM was concerned with long-term profitability. This suggests that logistics takes an intra-organisational focus whilst SCM has an inter-organisational perspective (Mills *et al*, 2004:1012).

Figure 2.3 Logistics Management



Source: Lambert and Stock (2001:3)

Lysons and Gillingham (2003) and Mouritsen *et al* (2003) suggest that there is common ground between logistics and SCM. This consideration has led writers such as Bowersox and Closs (1996) to regard the issues of logistics and SCM to be the same. Greenwood (1997) agrees with the observations of Bowersox and Closs (1996) by stating:

> *If we analyse what the experts are calling supply chain management we find that they are really talking logistics but driven by the requirements of the decade*
>
> (Greenwood, 1997).

A similar view is held by Waters (2003) outlining that when organising the flow of materials, the broad function of logistics also applies to a series of related activities, including:

- Procurement or purchasing – acquires raw materials from suppliers
- Inward transport – moves the materials from suppliers to operations
- Receiving – checks materials delivered and accepts them into operations
- Warehousing or stores – stores materials until they are needed
- Stock control – sets the policies for inventory levels, orders, etc
- Order picking – finds and removes materials from stores
- Materials handling – moves materials during operations
- Distribution – delivers finished goods to customers
- Recycling, returns, and waste disposal – to reuse, return, sell or otherwise dispose of materials not needed by the organisation
- Location – decides how many facilities there should be, and finds the best locations
- Communication – keeps and reports all records for the logistics system

Nevertheless, Cooper *et al* (1997a) distinguish between logistics and SCM, and regard the former as concerned with materials and information flows and inventories in the chain and SCM as the integration of all business processes[9] across the supply chain with a strategic perspective (Tan *et al*, 2002). These business processes include:

- Customer relationship management (CRM),
- Customer service management (CSM),
- Demand management (DM),
- Order fulfilment (OF),
- Manufacturing flow management (MFM),
- Procurement,
- Product development and commercialisation.

[9] A business process is defined as *a specific ordering of work activities across a time and place, with a beginning and end, clearly identified inputs and outputs, a structure for action* (Cooper *et al*, 1997a).

Offering a similar view to Cooper *et al* (1997a), Meijboom (1999) claimed that:

> *Logistics management stands for the integral control of goods flow and the information flows connected to the goods flow. Terminology in the logistics domain is far from unambiguous. Referring to the desired external integration, many authors prefer the term supply chain management, defined as the tuning process between the separate partners of the supply chain regarding planning, control, and the execution of the logistics processes. In other words, supply chain management tries to break down the barriers between the links in the supply chain in order to improve service and lower costs* (Meijboom, 1999:604).

This research adopts the view of authors such as Mills et al (2004) and Cooper *et al* (1997) who suggest that SCM is a broader concept than logistics because the former comprises a more strategic perspective (Tan *et a*l, 2002) such as collaborative relationships (Todeva and Konke, 2005).

This research project examines the power dynamics between the manufacturer and the retailer in the area of technology implementation and access control. For this task a comprehensive understanding of the relationships between the two actors as well as the circumstances that influence the situation has to be established. For this reason this study has to observe a SCM perspective rather than a logistics focus.

2.2.3.2 SCM as an extension to the purchasing function

An indication of the relationship between SCM and purchasing and supply can be identified by the title change of the Journal, 'Journal of Supply Chain Management: A global review of purchasing and supply (JSCM)'. From 1971-1973 the Journal was entitled 'Journal of Purchasing,' and from 1974-1990 it carried the title 'Journal of Purchasing and Materials Management'. The international perspective was included from 1990 when the journal was renamed 'International Journal of Purchasing and Materials Management'. From 1999, the journal has been named the Journal of Supply Chain Management (JSCM). The editor of the newly renamed academic journal, JSCM, Phillip L Carter (1999) commented in the inaugural copy:

> *The most obvious change is the title of the Journal. The new title acknowledges three important theses. First, it reflects the increasing emphasis on supply chain management as an overarching paradigm for research in purchasing and supply. Second, it preserves purchasing and supply as the historical foundation for the Journal and, as the platform for the Journal's view of supply chain management. Finally, it continues to highlight the global nature of supply chain management in both the manufacturing and non manufacturing sectors* (Carter, 1999:2).

In the article 'What is SCM?' Larson and Halldorsson (2002) discuss four conceptual perspectives on the relationship between purchasing and SCM. Appendix F illustrates the views of these authors on the emergence of SCM, using the categories of traditionalist, relabeling, unionist, and intersectionist. In this research, the researcher adopts the 'intersectionist' view, which regards SCM as including elements of logistics, operations, and purchasing. This perspective is chosen as the literature indicates that the concept of SCM intersects different management disciplines (Meijboom, 1999), and the scope of SCM is far greater (Cooper *et al*, 1997a) than 'traditionalist' and 'relabeling' perspectives. There is a similarity between 'intersectionist' and 'unionist' views, but the researcher believes that the 'unionist' view is ambiguous in identifying SCM boundaries. For example, it states 'SCM subsumes marketing, operations management and purchasing' but to what extent is not clearly argued. In the researcher's view other management areas (e.g. marketing, purchasing, and operations) operate autonomously and SCM involves elements from all these disciplines.

2.2.4 A definition of supply chain and supply chain management

According to authors such as Larson and Halldorsson (2002) and Lambert and Stock (2001), there is confusion regarding the definition of SC and SCM. In this section, the researcher will present his definitions of SC and SCM, outlining the key words important for this research. He will also state the purpose of constructing these definitions and the reasons for including certain key words.

A definition of SC:

> *Supply chain is a network of organisations which may be dispersed across the globe, formed to solve planning and control problems of operational activities by aligning the firm's information, material and financial flows to produce value added products and services from original supplier to end consumer through reduced cost and improved customer service*

The definition of SCM is a development from the SC definition.

A definition of SCM:

> *The Supply chain management is the strategic co-ordination of the SC, aiming to achieve its full potential, improving performance and, purpose by developing-buyer supplier relations through information integration, in order to compete effectively with rival SCs.*

Appendix G and H contain the definitions of SC and SCM respectively together with key words and references. As argued in sections 2.2.1 and 2.2.2 the existing definitions of SC and SCM do not provide comprehensive definitions on which to base this research. As a solution to this problem the author has constructed his own definitions through amalgamating existing definitions and including words important to this research (i.e. in SC -'dispersed across the globe', and in SCM -'potential, improving performance and purpose'). These additional words are not found in existing definitions. Key words relevant to this research but not found in other definitions include:

in SC - Dispersed across the globe/International dimension.

The international dimension has been neglected in most definitions. Most of the products sold by UK retailers are derived from international supply chains (Ferdows, 1997; Bruce *et al*, 2004'; Christopher *et al*, 2004 and Taplin, 2006). It is argued that in reality most products, in some part of the SC, from raw material to final assemblers, are likely to be sourced abroad (Guercini and Runfola, 2004). The popularity of international SCs is mainly due to cheaper labour costs, essential for price sensitive

markets (Kaufmann and Carter, 2002) such as the apparel industry (Chandra and Kumar, 2000 and Popp, 2000). Authors such as Murillo (2001), Ettlie and Sethuraman (2002) and Kaufmann and Carter (2002) address the international perspective of SCM but fail to give a definition including the international dimension.

in SCM -Potential, Improving Performance, and Purpose.

The words *potential, improving performance, and purpose* were included to reflect the fast moving, competitive environment in which SCM operates (Jaana and Timo, 2005). Most of the SCM definitions do not go beyond stating 'managing the SC'. According to Slack *et al* (1995), if companies are to survive in highly competitive markets they need to go further to improve potential and increase performance to *exceed* customer expectations (Harland *et al*, 1999 and Colotla *et al*, 2003).

The researcher agrees with Slack *et al* (1995), and believes that SCM should be more responsive to modern markets (Christopher *et al*, 2004 and Lowson, 2005), by first identifying the potential of the particular SC (through performance measures) and increasing its performance levels (Silveria and Cagliano, 2006) to fulfil the purpose more effectively, enabling the SC to *exceed* customer expectations and compete effectively (Birtwistle *et al*, 2003). By following this approach to SCM, improvement will be quicker and more receptive to modern dynamic markets (Swaminathan *et al*, 1995 and Lowson, 2001).

2.3 Collaborative Buyer-Supplier Relations (BSR)

Each echelon in the SC is both a buyer and a supplier (Stevens, 1989). This means that SCM deals with different buyer-supplier relationships simultaneously at times (Fynes *et al*, 2005). Swaminathan *et al* (1995), Christopher (1998) Akkermans *et al* (1999), Harland *et al* (1999), Fynes and Voss (2002) and Souviron and Harrison (2006) argue that buyer-supplier relationships are critical for SCM. Cooper *et al* (1997a) and Meijboom (1999) state that SCM *cuts across boundaries* in order to achieve the intended purpose. Observing a strategic perspective, authors such as Fawcett *et al* (2006) argue that SCM provides the benefit of cost inefficiencies whilst avoiding the burden of ownership. Other authors such as Coyle *et al* (1996) argue that the SC concept changed buyer supplier relationships to be collaborative rather than

competitive, moving from short-term, cost-based relationships to strategic, value-added relationships (Hoyt and Huq, 2000 and Todeva and Knoke, 2005). Recent literature suggests that collaboration is the basis for a successful SC (Barratt, 2004; Bonet and Paché, 2005; Todeva and Konke, 2005; Simatupang and Sridharan, 2005; Sheu *et al*, 2006 and Wilding and Humphries, 2006). It appears that most previous research considers the BSR between the manufacturer and the raw material supplier. Few studies review the relationship between the manufacturer and the retailer. Relevant research has been conducted by Christopher *et al* (2004), Bonet and Paché (2005) and Sheu *et al* (2006). These studies indicate that Western retailers rely on relationships for receiving deliveries on time. The main limitation of these studies is that they focus on the retailer's perspective and avoid reviewing the manufacturer comprehensively. There appears to be a gap in the literature discussing the manufacturer's perspective in the relationship with the retailer.

Williams *et al* (2002) argue that SC structure has evolved from the primary organisational structure of vertical integration to focus on inter-firm relations and that the emergence of e-supply chains (Auramo *et al*, 2002; Golicic *et al*, 2002; Agarwal and Shankar, 2003; Vlachopoulou and Manthou, 2003; Wagner *et al*, 2003; Iyer *et al*, 2004; Caputo *et al*, 2005 and Sherer, 2005) is placing more emphasis on buyer-supplier relationships (Hadjikhani and Thilenius, 2005).

The literature review indicates that buyer-supplier relations are traditionally discussed in marketing literature by authors such as Leonidou and Kaleka (1998) and rarely from an operations management perspective until after the millennium (Mills *et al*, 2004). Taking a marketing perspective, Olsen and Ellram's (1997) research on buyer-supplier relations discusses three areas:

1. Characteristics and benefits of buyer-supplier relations, which are also discussed by authors such as Sako (1992), Lamming *et al* (2001) and Fynes and Voss (2002).

2. Establishment and development of buyer-supplier relations, which discusses supply chain operations, focusing on logistical issues (Lambert and Stock, 2001). This area discusses the usefulness of integrated logistical activities such as efficient inventory management to avoid the amplification of inventory (also known as the 'bullwhip effect') (Lee *et al*, 1997a and Lee and Whang, 2001).

3. Management of buyer-supplier relationships (Harland, 1996 and Leonidou and Kaleka, 1998). This area presents discussions on SC modelling (Swaminathan *et al*, 1995). There is mathematically based research in this area to explain optimal strategies in terms of single stage and multiple stage chains (Samaranayake, 2005).

This research intends to examine the buyer-supplier relationship strength referring to some aspects mentioned in the framework proposed by Leonidou and Kaleka (1998). [Appendix I provides a description of buyer-supplier relationship strength measures used by these authors]. The intention is to determine circumstances involved in a long distance SC relationship between a developed and a developing country sharing different types of information (e.g. operational, tactical and strategic) (Graham and Hardaker, 2000 and Talluri, 2000). Information sharing can be restricted according to the dependencies in the buyer-supplier relationships (Svensson, 2002b; Cousins and Crone, 2003 and Samaranayake, 2005).

Appendix J illustrates research by previous authors on long-distance SC relationships. The main limitation of Leonidou and Kaleka's (1998) study is their choice of research context. Their study is based within Europe and the countries involved are similar in economic and cultural conditions. They focus on Cypriot manufacturing companies dealing with other European countries (e.g. between Cyprus and Italy). The geographical distance, cultural and economic differences in their research context are limited compared to the research context involved with this study. Authors such as Guercini and Runfola (2004), Christopher *et al* (2004) and Bruce *et al* (2004) state that the apparel SC has recently undergone a great deal of change due to global sourcing and this research has presented a newly identified importance for understanding the international perspective. It can be argued that the study by Leonidou and Kaleka (1998) provides an insight into regional SCs within Europe but it is unable to provide an understanding of long distance SCs.

2.3.1 Lead Firm in the Supply Chain

In a traditional SC, the manufacturer acts as the lead firm (Slack *et al*, 2001). In the apparel SC, the retailer assumes this position (Christopher *et al*, 2004 Croom, 2005 and Shere, 2005). The exploratory study in this research identified that in the UK – Sri Lanka SC the UK retailer is the lead firm. The control exercised by the lead firm plays

an important role in deciding the type and the depth of information shared in the SC (Swaminathan *et al*, 1995). The existence of a dominant player in the SC is discussed by several authors such as Croom (2005), Fawcett *et al* (2006) and Moedas (2006). Caputo *et al* (2005), claim that the 'leading actor' has the role of making key decisions in the SC to deliver higher value to the customer. According to Mouritsen *et al* (2003) the dominant player acts as a 'channel master' using its powers to coordinate processes among some of its suppliers and customers. It appears that the key player acts as the 'orchestrator' (Christopher *et al*, 2004) of the supply network, coordinating activities such as sourcing abroad for economic benefit. Research by Cox *et al* (2004) provides an insight into the power structure in the SC and the 'appropriateness' of the key player's sourcing strategies from a cross-industry perspective. Todeva and Knoke (2005) argue that new organisational structures are occurring according to particular types of strategic alliances. According to Williams *et al* (2002) and Caputo *et al* (2005) the use of electronic communication technology in the SC is creating structural changes. It appears that there is a strong link between structural change, use of electronic communications technology and BSR (Auramo *et al*, 2002; Golicic *et al*, 2002 and Vlachopoulou and Manthou, 2003). As a result, complex relationships are developing between buyers and suppliers in terms of: relational contracting, network organisations, strategic alliances and horizontal co-operations (Cousins and Crone, 2003). Fawcett *et al* (2006) argue that relationships are based on commitment and that little has been written on the levels of commitment along the SC or the type of governance structures. Cooper *et al* (1997b) argue that there are four SCM styles that may evolve over time: Dyadic Management, Channel Integrator, Analytic Optimization, and KEIRETSU/vertical integration. Descriptions of these styles are given in Appendix K. According to Cooper *et al* (1997b) in the apparel sector companies such as Benetton practice a 'Channel Integrator' approach.

2.4 SCM operational performance

In a competitive market the operational performance of SCM is vital for any organisation (New and Mitropoulos, 1994; Colotla *et al*, 2003 Cigolini *et al*, 2004 and Mills *et al*, 2004). SCM is a major contributor to the competitive strategies in business (Lambert and Stock, 2001; Christopher *et al*, 2004 and Cousins 2006). Johnson and Scholes (1999) and Mintzberg *et al* (1999) argue that the ability of a business to achieve sustained competitive advantage is largely determined by the operational activities, such

as SCM. Companies are required to measure their performance, to understand their competitive position in the market (Kotler, 2000 and Silveira and Cagliano, 2006) and make the necessary changes to remain competitive (Krajewski and Ritzman, 1993 and Christopher *et al*, 1998).

Hayes and Wheelwright (1984) developed a four-stage model, which can be used to evaluate the competitive role and contribution of the operations function to an organisation. The four stages model consists of: *internal neutrality, external neutrality, internally positive* and *externally positive.* Table 2.6 provides details of the model and describes the competitive contribution from each stage. The model reflects an ascending operating performance from stage one (internal neutrality) to four (externally positive), the fourth stage being the most desirable (Hayes and Wheelwright, 1984). According to Daugherty (1994), Gustin *et al* (1994) and Bowersox and Closs (1996), there is evidence to suggest that there is a positive correlation between information sharing and performance improvements. Fynes and Voss (2002) and Fynes *et al* (2005) argue that there is a positive relationship between buyer-supplier relations and performance. There is some empirical research to support the link between information sharing, buyer-supplier relations and operational performance by authors such as Harland *et al* (1999), Lamming *et al* (2001), Quayle (2002) and Fynes *et al* (2005).

Table 2.6 Four stages of operations management contribution

Stage		Competitive role of operations
Internal neutrality	Improving performance and higher contribution from operations function	Weakest level of contribution from operations. Follows a reactive strategy. Main objective is not to hold the organisation back.
External neutrality		First stage of competing against competitors. Adopting the best practice in the market. In other words, 'benchmark' from competitor's operations.
Internally positive		In this stage, the aim is to gain a clear view of the company's competitive and strategic goal and develop appropriate operational resources to excel in the areas in which the company needs to compete effectively.
Externally positive (Most desirable)		The difference between internally positive and this stage are that operations in this stage are more creative and proactive. This stage is more innovative in the sense that it adapts to market changes.

Adapted from: Hayes and Wheelwright (1984)

Unfortunately, Hayes and Wheelwright (1984) only discuss a broad view, which ignores

the impact on specific attributes such as cross structural visibility and access control according to the relationship strength. The link between buyer-supplier relationship styles and performance was outlined by Cox *et al* (2004), stating that there are three different types of relationships and performance outcomes: aligned; misaligned and suboptimal; and misaligned and dysfunctional. They suggest that, in an aligned relationship, buyers and suppliers use appropriate relationship management styles according to the power circumstances they are in, and achieve expected performance outcomes from the transaction. In a misaligned and suboptimal relationship, buyers and suppliers work with inappropriate relationship management styles, according to the power circumstances they are in. However, their research suggests that misaligned and suboptimal relationships can be realigned to improve performance outcomes if one or both parties change their behaviour. A misaligned and dysfunctional relationship tends not to be capable of realignment. The alignment of a supply chain is important for synchronisation because of the flow of materials, information and finance among the upstream and downstream entities in order to achieve optimum utilisation of resources (Porter, 1985). Lysons and Gillingham (2003) define supply chain management optimisation as:

> *The management of complex supply chains in their entirety with the objectives of synchronising all value adding production and distribution activities and the elimination of such activities that do not add value*
>
> (Lysons and Gillingham, 2003:87).

The topic of managing the members of a supply chain in an efficient and effective way has been the focus of recent studies, due to the growing importance of interconnected technologies such as the Internet (Cagliano *et al*, 2005). Research published by Upton and McAfee (1996) shows that interconnecting technologies like electronic data interchange (EDI) is most appropriate for linking members of a relatively stable community, and in particular a community in which one member is powerful enough to demand adherence to its communication standards (Croom, 2005). According to Slack *et al* (2001), the contribution of operations to business strategy is threefold: operations as an *implementer, supporter* and a *driver* of business strategy (See Table 2.7 for an explanation of the three perspectives). The boundaries of these three roles overlap at best. Nevertheless, operations play an important part in the overall business strategy of an organisation (Cousins, 2005).

Table 2.7 Operations contribution to business strategy

Role of operations in strategy	Example
Implementer	Operations undertake new or improve existing activities to achieve the objectives set by business strategy.
Supporter	Operations develop organisational resources to provide the capabilities, which are needed to allow the organisation to achieve its strategic goal.
Driver	Operations provide short-term and long-term competitive edge by conforming to current markets as well as making necessary changes to cope with future challenges.

Adapted from Slack *et al* (2001: 39-40)

Barnett (1996) suggests that performance, also referred to as productivity, is a way of *recording* the current work method and *analysing* it, with the purpose of subsequently *improving* it. The meaning of performance and its content has been discussed in various ways by authors over several decades (Hayes and Wheelwright, 1984; Hill, 1989; Krajewski and Ritzman, 1993 and Barnet, 1996).

Hayes and Wheelwright (1984) proposed competitive priorities in which performance can be measured: cost, quality, dependability and flexibility. Hill (1989) refers to performance objectives as 'order winning' and 'qualifying criteria': cost, quality, delivery, range and design leadership. Krajewski and Ritzman (1993) measure performance according to cost, quality, time, flexibility and trade-offs, considered as the most important performance objectives or 'competitive priorities'. Combining these views, Slack *et al* (1995) introduced five performance objectives: cost, quality, speed, flexibility and dependability. The performance criteria proposed by different academics are illustrated in Table 2.8, in order to establish suitable performance objectives for this research.

Table 2.8 Operations management performance objectives

Author	Criteria
Hayes and Wheelwright (1984)	Cost, quality, dependability, and flexibility
Hill (1989)	Cost, quality, delivery, range, and design leadership
Krajewski and Ritzman (1993)	Cost, quality, time, flexibility and trade-offs
Slack *et al* (1995)	Cost, quality, speed, flexibility and dependability

Source: Literature review

A clear observation from the above table is that some of the performance measuring

criteria have not changed over several decades. Observing this fact Barnett (1996) states:

> *Every organisation needs to be productive, and to this end over a period of about 75 years different means have been devised to help achieve this. Much of the development work took place at the beginning of the 20th century and after, and a lot of what was done then is still valid and is used today.*
>
> (Barnet, 1996: 192)

The performance objectives (or measures) most widely accepted from Table 2.8 are: cost, quality, and flexibility. Some examples of performance measures are illustrated in Table 2.9. According to Johnston *et al* (1997) and Mill *et al* (2004), performance measurement is the quantification of the performance of an operation. Outlining the performance measuring process Johnston *et al* (1997) state:

> *Performance measurements may be carried out at a broad level in terms of the operations performance objectives, although this does not help operations managers make decisions about exactly what to change. These performance objectives will usually be measured using a variety of more detailed second order measures, some of which may impact on one or more performance objectives (*Johnston *et al,* 1997:381).

Table 2.9 Examples of performance measures

Performance criteria	Second order measures
Quality	Number of defects, scrap level, customer complaints, customer satisfaction rating
Speed	Order lead-times, customer processing times, frequency of delivery
Flexibility	Time to market new products or services, range of products and services, ability to make changes to schedules (volume and timing)
Cost	Variance against budget, utilisation of resources, added value
Dependability	Percentage of late orders, adherence to schedule, availability of products or services.

Adapted from Johnston *et al* (1997: 381)

The use of ICT to achieve speed, flexibility and dependability are particularly relevant to this research. The speed in the apparel SCs are examined according to their use of

ICT tools. Achieving faster cycle times, timely information dissemination and response time appears to be important in the apparel SC. The flexibility aspect refers to the ability to alter communication channels (for example, inter-departmental data sharing). The dependability of communication is important in terms of quality and clarity of data and the data reaching the intended recipient. Additionally, the study considers dependability of internal and external customers for integrating the system.

2.4.1 Logistic strategies

This section discusses several Supply Chain (SC) strategies and identifies strategies adopted by the apparel industry. Supply chain strategy varies according to the industry (Bowersox and Closs, 1996). Some of these strategies are not relevant to the apparel sector (Bruce *et al*, 2004). For example, in the food industry, the main priority is to provide fresh produce (Van Hoek, 1999). Therefore this industry operates an agile SC to move perishable goods on time. On the other hand, the majority of apparel supply chains adopt a lean approach to minimise cost (Chandra and Kumar, 2000). Here the priority is to reduce product prices to gain a competitive advantage (Abernathy *et al*, 2000).

Supply chain strategy also varies according to the activities of the particular entity. For example, the retailer's strategy is focused on satisfying one party (i.e. end consumer), whereas the manufacturer may have several internal customers that he/she has to satisfy (e.g. buying offices, distributors and retailers). Apparel manufactures adopt two main strategies: make to stock and make to order (Meijboom, 1999).

1 In a make to order scenario, the manufacturer produces goods to replenish inventory levels at the retailer. The manufacturing process is initiated after a purchase order (PO) issued by the retailer. This operates in a lean SC context.

2 In a make to stock strategy, manufacturers use technology such as CPFR and cross decking to identify product demand at the retailer's shop floor and produce goods accordingly. An agile SC is essential for this strategy because it has to respond to demand in a short period. Integration is a key requirement.

For example, Zara and Benetton are two apparel organisations that use agile sc strategy

to achieve high levels of responsiveness to customers (Christopher *et al*, 2004). The strategy at Zara is that labour intensive stages are outsourced to about 300 subcontractors whilst value adding activities such as dying, cutting, labelling and packaging are conducted in-house. Similarly, Benetton acts as a 'virtual SC architect' or an 'orchestrator' (Salmer and Spence, 2001). Colour dying is the only activity conducted in house. Benetton outsource key areas in the value chain. The manufacturing function, distribution and even the retail stores are not owned by them.

Sri Lankan apparel manufacturers are operating in a lean SC and adopt a make to order strategy and therefore ECR strategies used by companies like Zara and Benetton do not apply to the companies being researched (Christopher *et al*, 2004). For example, Benetton use decoupling of their SC as upstream and downstream activities. Upstream production orders are anonymous because design is generic. Downstream production represents individual customer orders (Meijboom, 1999). This is not the case in the companies of this research because they are employed only for sewing of the garment. In conclusion apparel manufacturers in Sri Lanka are used by retailers to gain cost benefits rather than for responsiveness. Table 2.10 summarises apparel industry SC strategies.

Table 2.10 SC manufacturing strategies in the apparel industry

Strategy	Discussion		References
Lean	A lean SC focuses on cost efficiencies to gain competitive advantage. Increasing the cost benefits of economical labour charge rates, a lean strategy reduces the waste of unnecessary inventories. Retailers do not place large orders ahead of the season as previously. Instead they use a continuous inventory replenishment programme managed by the manufacturer using ICT tools such as collaborative planning forecast and replenishment (CPFR) or cross-decking for flow through distribution. This means that apparel manufacturers are faced with the risk of inventory management at their end.		Garry, 1994c; Abernathy *et al*, 2000; Bruce *et al*, 2004; Christopher *et al*, 2004
Agile	A manufacturer operating an agile SC is able to accommodate time variations and service requirements stipulated by the retailer. The principle of an agile SC is to operate a flexible, responsive and individually tailored product profile. Some apparel manufacturers provide personally customised product ranges routinely (e.g. printed logos on tee shirts). An agile SC is essential for mass customisation and postponement strategies.		Abernathy *et al*, 1995; Fisher and Raman, 1999; Forza and Vinelli, 2000; Fisher *et al*, 2001; Christopher *et al*, 2004
Postponement	Postponement or delayed differentiation strategy is the process of packaging a standard product in different ways. This strategy can be sub - divided in to three generic types: form, time and place. In this strategy the apparel manufacturer holds inventory in a unfinished state waiting final assembly until final demand is known. It reduces lead-times and creates leaner working due to increase in volume of standard parts. Collaboration and high visibility are essential for success. Postponement adopts a pull system of inventory control or an efficient customer response (ECR) approach.		Bucklin, 1965; Ellram *et al*, 1989; Bowersox and Closs, 1996; Lampel and Mintzberg, 1996; Womak and Jones, 1996; Harris *et al*, 1999;Van Hoek, 1999; Chandra and Kumar, 2000
Mass customisation	Mass customisation is the ability to offer individually tailored products or services on a large scale. Mass customisation is the opposite of mass production implemented by Fordism. Mass customisation provides product variety to customers.		Van Hoek 1997; Meijboom, 1999; Zipkin, 2001
	Engineer to order	Complex product designs with long lead-times, project contracts	
	Make to order	Customer designs the product and gives to the manufacturer to produce	
	Make to stock	Standard commodity items are stocked awaiting orders	
	Assemble to order	Standard products or subassemblies are stocked and configured according to customer specified options	
	Continuous production	Used for items with a continuous SC (e.g. water, gas and electricity)	
	3 PL	Third party logistics or outsourcing the distribution flow is aimed at maximising value and minimising cost. The 3PL provider's commitment increases with the level of integration in the SC. In the apparel industry, third party buying offices act as an intermediary between retailer and manufacturer and provide front office functions (e.g. marketing, and delivery of shipment).	Popp, 2000; Razzaque and Sheng, 1998; Stock and Lambert, 1998
	4 PL	Fourth party logistics provider is the practice of using ICT to add value through an e-supply chain. The main purpose of the 4PL provider is to integrate the SC.	Van Hoek, 2001

2.5 Summary of section one

This study is considered from an operations management perspective in the area of supply chain management. The chapter began by defining the three words, which create the term supply chain management and introduced it as a young and developing concept. It was explained that there is ambiguity regarding the exact boundaries of supply chain management mainly because it has evolved through other disciplines such as logistics, marketing, and purchasing. As a consequence, the subject area lacks a standard definition. In order to provide a foundation for this research several definitions were reviewed by analysing them according to entities, activities and purpose. None of the existing definitions appeared suitable for this research and therefore an appropriate definition was constructed including the key words important to this study. The origins of SCM were discussed explaining the difference between materials management, physical distribution management, logistics, and SCM. The literature review explained that logistics is an activity or a function, a supply chain is a combination of entities focused on planning and controlling the three flows: material, information, and financial. This research focuses on the information flow (i.e. communication), evident in SCM and argues that better information flow will improve coordination. It explained that SCM is the strategic coordination of the SC, focused on intersecting boundaries and developing relationships and a main contributor to competitive advantage. The importance of BSR for a collaborative SC was identified. The literature indicates that there is a link between BSR, information sharing and organisational structural change. The concept of a dominant player to control the SC was identified. The link between performance improvement and information sharing was discussed using the Hayes and Wheelwright (1984) model. It appears that the performance objectives are interrelated and interdependent. Performance measurement criteria suitable for this research were highlighted as speed, flexibility and dependability. This section concludes with the argument that information sharing and BSR are two themes vital to understanding SCM. The next section discusses in more detail the advantages facilitated by electronic technology.

Section Two - e-Business

2.6 Introduction

> *It is often claimed that information and communication technologies (ICT) will be for the economy what steam and machine power were to the industrial revolution* (Van Hoek, 2001a:21).

The previous section indicated that information sharing is a main aspect of SCM and identified that it underpins this research. This section provides details about information sharing through electronic communications and it will establish the parameters of e-Business concerned with this study. This research answers the call for further research in this area by authors such as Auramo *et al* (2002) and Golicic *et al* (2002) and Gubi *et al* (2003). The following statement outlines the difficulty of undertaking research in this area because of its fast changing nature:

> *E-Business have been launched, progressed to Internet protocol (IP), grown and then collapsed in less time than a typical PhD student might take to complete the literature review study and fieldwork of his or her dissertation* (Drew, 2004:2).

According to Clarke (2000), significant obstacles to academic study in this area include:

- its recent emergence
- the rapid change that has always characterised the domain
- the very substantial variation in behaviour in apparently similar contexts
- the enormous attention paid by media marketing interests, with inevitable distortion of terminology and data
- the lack of familiarity with e-Business technologies by many management scholars
- the lack of established instruments and research approaches.

Taking these obstacles into account, this part of the chapter examines both academic literature and practitioner (e.g. AMR research, Accenture, Forrester Group, Garter Group, KPMG and Morgan Stanley). The parameters of this study are set on

investigating ICT implementation (Shiels *et al,* 2003 and Power, 2005b) and information sharing practices (Moberg *et al,* 2002; Ratten, 2004; Closs *et al,* 2005 and Li *et al,* 2005).

According to Turban and King (2003) and Croom (2005) e-Business emerged through the proliferation of the Internet to create a platform for inter-organisational systems (IOS) (Silveira and Cagliano, 2006) during the late 1990s, and has had a significant impact on the operational and strategic management of supply chains and networks (Cagliano *et al,* 2005; Caputo *et al,* 2005 and Samaranayake, 2005). Authors like Adam *et al* (1999), explain that the roots of e-Business spread as far back as the late 1960s and early 1970s, when companies were using electronic data interchange (EDI) through dedicated lines between companies (Kosiur, 1997). These computer-to-computer digital communications displaced traditional forms of data and information interchange like direct-link telephones and mailed invoices (Murillo, 2001:370). Section 2.7.5 provides discussion on the evolution of electronic communications.

The impact of e-Business on SCM has generated substantial interest in both academic and industrial sectors (Van Hoek, 2001a; Ross, 2002; Cagliano *et al,* 2005 and Croom, 2005). Quayle (2002:1148) argues: *there is a great deal of 'hype' about e-commerce*. Hype surrounding EC is outlined by Adam *et al* (1999):

> *While many electronic trading technologies have had radical effects within their own markets and created their fair share of publicity, none have attracted the level of hype or have been hailed as purveyors of economic transformation to the extent that electronic commerce has in recent years* (Adam *et al,* 1999:1).

Taking a similar view to Adam *et al* (1999), Cagliano *et al* (2003) argue that:

> *Information and communication technology has fostered the development of powerful tools that are expected to improve supply chain performance dramatically through higher levels of process efficiency and integration. Despite the initial enthusiastic expectations, it is not completely clear how relevant these technologies are for companies and what actual benefits can be obtained. In fact there is still poor evidence of actual implementation and effectiveness of e-Business practices* (Cagliano *et al,* 2003:1142).

It appears that software solution providers and other computer services related firms generate hype for media and marketing interests, with inevitable distortion of terminology and data (Clarke, 2000). McIvor and Humphreys (2004:242) mention that: *Cisco Systems reports that one-quarter of its orders used to have to be reworked because of errors in telephone and fax ordering systems.* According to Williams *et al* (2002) *IBM reduced the costs of purchased goods and services by $4.2 billion by employing internet-based procurement. AMR research has indicated that high-tech procurement organisations have been able to save $100 per purchase order when issuing electronic rather than traditional of purchase orders.* Such statements seem barely credible and point to the possibility of exaggeration. Considering the unsubstantiated nature of these claims, there appears to be a need for empirical study.

The impact of e-Business can be observed from a variety of perspectives as it impacts across different industrial sectors and management disciplines like marketing, human resource management and operations (Chaffey, 2002; Cagliano *et al*, 2003; Croom, 2005 and Turban and King, 2003). E-Business is a recent phenomenon: its boundaries in terms of capabilities, limitations and applicability are still uncertain (McIvor and Humphreys, 2004:266). Lancioni *et al* (2000:47) argued that *there have been few, if any, studies done on the use of the Internet in SCM.* Murillo (2001) and Iyer *et al* (2004) indicate that the impact on an institution's infrastructures from e-Business and supply chain management must be examined in more detail. Consequently, the researcher aims to establish the capabilities and limitations of e-Business, in an investigation of its impact on SCM.

The first wave of electronic communications started in the form of e-commerce in the mid 1990s, focusing on the B2C segment (Cunningham and Fröschl, 2001). E-Commerce provided a tool for improved customer accessibility to the market and as a result, many 'dot.com' companies were formed (Turban and King, 2003). This boom was short-lived, as expected or promised advantages were not achieved for several reasons, including lack of understanding by managers of how to operate their systems effectively (Chaffey, 2002 and Van der Vorst *et* al, 2002), and customer dynamics such as preference to view the product face-to-face before purchase (Chaffey, 2002).

The second wave of electronic communications is currently expanding across the

business sector, mainly focusing on the B2B segment of the market and is referred to by many authors as e-Business (O'Keeffe, 2001; Poirier and Bauer, 2001; Chaffey, 2002; Cagliano *et al*, 2003 and Lysons and Gillingham, 2003). Turban and King (2003) argue that the emphasis has shifted from B2C to B2B in the electronic communications environment recent years. They argue that the reasons for the emergence of the second wave, were industry failure in the late 1990s.

Internet-enabled markets expand choices for buyers and give access to suppliers to find new customers and reduce transaction costs for everyone involved (Williams *et al*, 2002). It is estimated that online purchasing could save firms anything from 2 per cent in the coal industry to perhaps 40 per cent in electronic components (Dale, 2000). Accordingly McIvor and Humphreys (2004) state that:

> *The importance of B2B commerce is increasing dramatically, either as private networks connecting co-operating organisations, or as networks linked through the Internet* (McIvor and Humphreys, 2004:242).

This research attempts to understand whether the second wave of electronic communications, specifically e-Business, delivers the promised benefits (e.g. better information sharing, improved quality, lower cost, coordination, collaboration, and better BSR) - or is it going to result in a similar outcome to the first wave? The benefits of e-Business argued by both academics and practitioners are mostly still anecdotal or incomplete (Cagliano *et al*, 2005). Moreover, the ambiguity of terminology presents difficulties in understanding its exact meaning and scope (Graham and Hardaker, 2000 and Van der Vorst *et al*, 2002). Authors such as Van der Vorst *et al* (2002) and Turban and King (2003) argue:

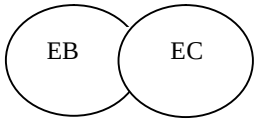
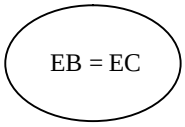
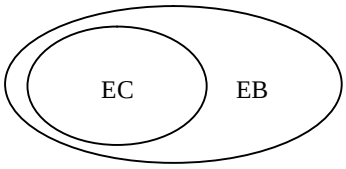
> *Many terms are used in the literature to describe activities concerning the use of ICT (information and communication technologies) between organisations and their environment, including suppliers and customers. In most cases the terms are not defined exclusively* (Van der Vorst *et al*, 2002:121).

> *Some people define the term commerce as describing transactions conducted between business partners. When this definition of commerce is used, some people find the term electronic commerce to be fairly narrow. Thus, many use*

> *the term e-Business. E-Business refers to a broader definition of e-commerce, not just the buying and selling of goods and services, but also servicing customers, collaborating with business partners, and conducting electronic transactions within an organisation* (Turban and King, 2003:3).

Chaffey (2002:8) offers three views of the relationship between e-commerce and e-Business. See Table 2.10 for the three alternative views.

Table 2.11 Three alternative definitions of the relationship between e-Commerce and e-Business

	View	Diagram	Source
a).	EC has some degree of overlap with EB.	 Overlap	Cunningham and Fröschl (1999)
b).	EC is broadly equivalent to EB	 Equal scope	Murillo (2001), Laudon and Traver (2001)
c).	EC is a subset of EB	 EB wider than EC	Turban and King (2003), Van der Vorst et al (2002), Chaffey (2002), Poirier and Bauer (2001)

EC = e-Commerce, EB = e-Business

Adapted and developed from: Chaffey (2002:8).

The first view (a) may be realised in the future as technology improves and facilitates more consumer participation, improving the scope of e-commerce (Poirier and Bauer, 2001). Concerning the second view (b), the scope of EB the same as EC (Laudon and Traver, 2001 and Murillo, 2001). In the third view (c), e-commerce software operates largely as a subset of EB (Poirier and Bauer, 2001; Van Hoek, 2001; Chaffey, 2002; Van der Vorst *et al*, 2002; IBM 2003; Microsoft 2003 and Turban and King, 2003). This research adopts the third view (c), regarding e-commerce as a subset of e-Business. Note that in this research e-commerce and e-Business may be used interchangeably

during the literature review. However, the focus of this research is e-Business, as defined by Van der Vorst *et al* (2002), Chaffey (2002) and Turban and King (2003).

Murillo (2001) argues that the scope of e-commerce spreads across three categories: business, consumers and government. See Table 2.11 to view categories and segments covered by e-communications.

Table 2.12 Components of e-commerce with sample economic activities

Category	Business	Consumer	Government
Business	B2B Supply chain, wholesalers	B2C Retailers (goods or services)	B2G Contract bidding, privatisation
Consumer	C2B Public bidding marketplaces, auctioneers	C2C Public flea markets	C2G Public government auctions
Government	G2B Tax and fees collection	G2C Tax and fees	G2G Budget allocation

Adapted from: Murillo (2001:372)

The above table illustrates the broad segments of e-commerce. This research focuses on the B2B segment and excludes other segments, which involve the end-consumer and the government. In the subsequent section, e-commerce and e-Business definitions are analysed to establish a working definition for this research.

2.7 Analysing e-Commerce and e-Business definitions

Several authors have proposed definitions of e-commerce and e-Business (Kosiur, 1997; and Roelops, 1998, cited in; Van der Vorst *et al*, 2002; Adam *et al*, 1999 and Golicic *et al*, 2002). It appears that recent studies about e-Business only discuss specific aspects of it in terms of strategy (Cagliano *et al*, 2005 and Croom, 2005), e-collaboration (Cassivi *et al*, 2004), e-SC (Caputo *et al*, 2005 and Sherer, 2005) and implementation (Power, 2005b) but none of these studies provides a comprehensive definition of e-Business. Appendix L illustrates a sample of available definitions analysed according to segment (B2B or B2C), category (e-Business or e-commerce), entities, activities and purpose. Definitions of both e-commerce and e-Business are evaluated to determine the most suitable for this research.

The evaluation criteria for choosing a fundamental definition include:

1).Whether the e-commerce or e-Business definition is appropriate for this research. As this research focuses on the B2B segment it appears that e-Business may be more suitable. In order to be certain, Appendix L contains definitions according to e-commerce and e-Business.

2).Key words relevant to this research, for example, information sharing, communication, B2B streamlining of process and explicit recognition of SCM. Most research discusses e-Business as an inherent part of SCM but avoids including it in the definition. This leaves ambiguity as SC and electronic communication develop into other forms with superior capability. For example, SC evolution as supply networks (Samaranayake, 2005) may change the governance structure (Fawcett *et al,* 2005).

The idea of establishing a fundamental definition from the above table proved unsuccessful as none of those definitions provided a comprehensive platform to base this research in terms of entities, activities and purpose. As a solution to overcome this problem, the author will construct his own definition in Section 2.7.3.

2.7.1. Observations from Appendix L

a). We argue that e-Business definitions suit this research better, mainly because e-Business involves more B2B processes and covers a wider scope for discussing information sharing (www.ibm.com/e-Business).

The DTI (2000) definition is focused on e-Business. Similarly to the DTI, authors such as Van Hoek (2001), Chaffey (2002) and Turban and King (2003) argue that e-Business definitions better represent the B2B segment, as they emphasise business activities and processes. Taking the view that e-Business is more focused on B2B processes than e-commerce Chaffey (2002) argues:

> *E-commerce does not refer to many of the transactions within a business, such as processing a purchase order, that are part of e-Business* (Chaffey, 2002:8).

b). Definitions focus on either B2C or B2B. For example, Adam *et al* (1999) give the

following aim: *reduce product and service cost and improve customer response time and quality*. This definition is B2C or consumer orientated as it indicates end consumer orientated activities (i.e. improve customer response time) rather than B2B processes like integration of business processes (Van der Vorst *et al*, 2002). Roelops (1998) emphasises the B2B segment of EC, and summarises the main activity of EB as*: the streamlining of all business processes.*

c). In general, e-Business definitions focus on B2B and e-commerce definitions focus on B2C segments as noted in Appendix L. The exception includes the definition by the government (Cabinet Office, 1999), which discusses B2C, B2B, and e-Business and e-commerce activities together.

d). In some definitions, there are common 'activities' between e-Business and SCM: for example, e-Business and SCM both focus on streamlining the business processes to *improve the efficiency and effectiveness of the complete supply chain* (Lambert *et al*, 1998 and Roelops, 1998). See Appendix E for definitions of SCM. The literature suggests that the base for both e-Business and SCM is information sharing (Beach *et al*, 1998a; Min and Galle, 1999; Pires *et al*, 2001; Van Hoek, 2001 and Van de Vorst *et al*, 2002).

e). The definition of e-commerce given by the Cabinet Office (1999) and the e-Business definition of Roelops (1998) show a direct link to SC. The inclusion of SC in these definitions may suggest:

i). E-commerce and e-Business technologies are increasingly used in SCM.

ii). The impact of e-commerce and e-Business on SCM is generating interest across a wide range of organisations in the private and public sectors.

The government's interest in the impact of e-commerce on SCM is illustrated clearly in the document they produced, entitled e-commerce@its.best[10]. This is shown in that part of the definition of the Cabinet Office 1999, which states: *E-commerce is the exchange*

[10] The government produced a document titled e-commerce@its.best.uk containing 128 pages advocating the benefits of e-commerce. The document does not make a distinction between e-commerce and e-Business. It argues the importance of e-commerce (in general) and outlines the government's commitment to its development.

of information across electronic networks, at any stage in the supply chain.

2.7.2 Main reasons for not choosing a definition from Appendix L

a). Key words such as information sharing (Shore and Venkatachalam, 2003), communication network (Sherer, 2005) and streamlining business processes (Lee and Whang, 2001 and Disney and Towill, 2003) are not discussed in existing definitions.

b). Definitions are constructed from different perspectives. This has affected the configuration of the definitions. For example:

I). Scope

Some definitions are broad and do not discuss specific entities, activities or purpose: IBM defines e-Business as: *the transformation of key business processes through the use of Internet technologies*, without outlining specific activities or entities involved. This may suggest that:

> i). The concept of EC is partly unexplored and the real (rather than perceived) capabilities and limitations are still empirically not proven (Cagliano *et al*, 2005), and/or:
>
> ii). A broader definition is desirable, as it would accommodate the inclusion of new capabilities of EC, which may be added in the future, preserving the generalisability and time validity of the definition.

II). Segment

Some definitions do not clearly focus on one segment (B2C or B2B). For example, definitions by the Cabinet Office (1999) and Kosiur (1997) are broad and do not concentrate on a particular segment.

III). Entities, activities, and purpose

Some definitions differ in terms of entities, activities and purpose: the Cabinet Office's

(1999) definition is flexible, broad, and focuses on including all the entities affected by e-commerce (i.e. comprehensively covering everyone), but ignores specific activities or purpose. This is shown in the part of the definition which states: *whether within an organisation, between businesses, between businesses and consumers, or between the public and private sector, whether paid or unpaid.* Contrary to the Cabinet Office (1999) view, the definition given by the DTI (2000) argues specific activities and purpose of e-Business, but fails to outline the entities involved.

IV). Category

There is ambiguity regarding classifications of e-Business and e-commerce. In some definitions the meaning is used interchangeably (e.g. Cabinet Office, 1999). The terminology (i.e. e-Business and e-commerce) has changed over the last few years to incorporate additional activities facilitated by improved technology and better understanding of the subject (Turban and King, 2003).

Authors such as Poirier and Bauer (2001) and Van der Vorst *et al* (2002) argue that e-commerce was the first to surface, and as new possibilities emerged, the term e-Business was coined to illustrate the wider scope of e-commerce (Turban and King 2003). As stated earlier, there is disagreement among researchers about the relationship between e-commerce and e-Business (Chaffey, 2002). Different literature sources refer to e-commerce and e-Business interchangeably (Min and Galle, 1999 and Power, 2005a). This is because exclusive terms are yet to be established (Van der Vorst *et al*, 2002). This only serves to confuse. As identified earlier, this research considers e-commerce as a subset of e-Business.

2.7.3 A definition of Electronic Business

The review indicates that there is still ambiguity regarding the exact scope of e-Business and e-commerce (Cagliano *et al*, 2005). According to authors such as Chaffey (2002), Van der Vorst *et al* (2002) and Turban and King (2003), there is ambiguity regarding the definitions of e-Business and e-commerce. In this section the researcher proposes his own definition of e-Business. As argued before, e-Business definitions suit this research better as it focuses more on B2B processes (refer to Section 2.2.2) and covers a wider scope for information sharing (Bajgoric, 2006). The proposed definition will

incoporate key words relevant to this research. Section 2.7 identified the criteria for choosing a definition from the existing literature (i.e. information sharing, communication, streamlining of business processes and SCM). A summary of the observations from Appendix L were identified in 2.7.1 and section 2.7.2 argued none of those definitions are appropriate for this research. The available definitions were discared due to lack of key words in each definition and variations caused by different views in terms of scope, segment, category etc.

A definition of e-Business

> *E-Business is a platform for communications and information sharing between business to business or business to consumers, which enables the streamlining of business processes involved in SC, and may facilitate efficient, effective performance improvement in SCM*

Appendix M contains a definition of EB with references supporting the key words which are not included in available definitions.

2.7.4 Scope of Electronic Business

This section evaluates the e-Business impact on SC operations and identifies the area of investigation for the present study. According to authors such as Adam *et al* (1999), Cunningham and Fröschl (1999), Porter (2001), Croom (2005) and Turban and King (2003) the Internet will undeniably impact the way business is conducted. However, this will not help managers who want clear answers on how to reduce cost and improve performance in their operations (Cagliano *et al,* 2005). This research aims to provide specific details about capabilities and limitations of e-Business by comparing e-Business to previous tools like direct-link telephones or fax.

The literature review indicates that structural changes (Quayle, 2002; Iyer *et al,* 2004; Power, 2005a and Samaranayake, 2005) are occurring in SC (Caputo *et al,* 2005), due to new electronic communication methods (Lau and Lee, 2000; Williams *et al,* 2002 and Croom, 2005). This is mainly because of information sharing (Auramo *et al,* 2005). For example, Lewis and Suchan (2003) argue that structures are workers' mental blueprints for action within a specific organisational context. In other words they claim

that people's actions produce structures. New communications with e-mail or msn chat methods have shifted the way people act and as a result the organisational structure is changing. Many research projects have been dedicated to identifying the effects of e-Business on SCM in the last few years (Caputo *et al*, 2005 and Croom, 2005). However, there is still ambiguity regarding the exact scope of e-Business (Cagliano *et al*, 2005). A possible reason for this could be that e-Business effects are context specific (Christopher *et al*, 2004), depending on the type of ICT tools that are used. Examples of these are quick response (QR) in the apparel industry and efficient consumer response (ECR) in the grocery industry.

In this research we consider e-Business to take a variety of forms like EDI[11], enterprise resource planning (ERP), XML[12], mobile telephone, and direct link-ups with suppliers, Internet, intranet, extranet, electronic catalogue ordering, and e-mail (Murillo, 2001; Quayle, 2002 and Auramo *et al*, 2003). There is a variety of ICT tools that can be used to enable e-Business (Bajgoric, 2006) and can be used individually or in combination (Talluri, 2000). E-Business enables many capabilities and benefits (Min and Galle, 1999; Laudon and Traver, 2001; Porter, 2001; Quayle, 2002; Chaffey, 2002; Power, 2005a).

Arguing the benefits of e-commerce to SCM Quayle (2002) states that:

> *E-commerce can enhance SC efficiency by providing real-time information regarding product availability, inventory level, shipment status, and production requirements* (Radstaak and Ketelaar 1998*). It has vast potential to facilitate collaborative planning among supply chain partners by sharing information on demand forecasts and production schedules that dictate supply chain activities* (Karoway 1997*). It can effectively link customer demand information to upstream supply chain functions (e.g. manufacturing, distribution, and sourcing) and subsequently facilitate "pull" (demand driven) supply chain operations* (Kalakota and Whinston, 1997*)* (Quayle, 2002:1149).

[11] There are two types of EDI: Traditional EDI and Internet EDI (Min and Galle, 1999 and Cunningham and Fröschl, 1999). This research considers both types of e-Business.
[12] System to system integrations – extended mark up language.

Outlining the capabilities of e-Business, Min and Galle (1999) argue:

> *The increased popularity of e-commerce is due to operational benefits it can bring to purchasing practices. For example: cost savings resulting from reduced paper transactions, shorter order cycle time and the subsequent inventory reduction resulting from speedy transmission of purchase order related information, and enhanced opportunity for the buyer/supplier partnership through establishment of a web of B2B communication networks.*
>
> (Min and Galle, 1999:909-910)

The above statements claim that e-Business delivers many capabilities and benefits (Nikolaeva, 2006). Table 2.13 provides a summary of the impact of e-Business on SCM performance. However, most of these claims remain anecdotal (Cunningham and Fröschl, 1999; Delfmann, 2002; Jutla *et al*, 2002 and Cagliano *et al*, 2005). This research investigates the last benefit advocated by Min and Galle (1999:910): *enhanced opportunity for the buyer/supplier partnership* (Agarwal and Shankar, 2003 and Silveira and Cagliano *et al*, 2006) *through establishment of a web of B2B communication network* (Cross 2000); and the benefit advocated by Quayle (2002:1149): *EC has vast potential to facilitate collaborative planning* (Cassivi *et al*, 2004; Simatupang *et al*, 2004; Bonet and Paché 2005 and Todeva and Knoke, 2005) *among supply chain partners by sharing information* (Shore and Venkatachalam, 2003 and Closs *et al*, 2005) *on demand forecasts and production schedules* (Smäros *et al*, 2003 and Dorling *et al*, 2006) *that dictate supply chain activities.*

Table 2.13 Impact of E-Business on Supply Chain Performance

Revenue-enhancing Opportunities	Cost reduction Opportunities
Offering direct sales to customers	Reduce product handling with a shorter supply chain
Providing 24 hours access from any location	Postponing product differentiation until after an order is placed
Aggregating information from various sources	Decreasing delivery cost and time with downloadable product
Providing personalisation and customisation of information	Reducing facility and processing costs
Speeding up time to market	Decreasing inventory costs through centralisation
Implementing flexible pricing	Improving supply chain co-ordination through information sharing
Allowing process and service discrimination	--
Facilitating efficient fund transfer	--

Source: Chopra and Meindl (2001)

Table 2.13 identifies several benefits for SCM performance facilitated by the impact of e-Business. However, these claims are anecdotal and need empirical research. With reference to Table 2.13, this research intends to empirically investigate advantages:

Number 5 a*ggregating information from various sources,*
Number 7 *providing personalisation and customisation of information,*
Number 9 sp*eeding up time to market,*
Number 12 improving *supply chain co-ordination through information sharing*.

Auramo *et al* (2003) provide five propositions on the use and benefits of e-Business: improved customer service, improved efficiency of critical business activities, improved information quality, support for planning collaboration and improved agility of the supply network. According to Auramo *et al* (2003), in order to gain strategic benefits, the use of IT has to be coupled with process redesign.

Some authors such as Delfmann *et al* (2002) remain sceptical about the benefits of e-commerce:

> *The impact of e-commerce on business environments is often praised but seldom analysed with scrutiny* (Delfmann *et al*, 2002:203).

There appear to be few articles arguing the negative aspects of e-Business. A possible reason for lack of literature in this area could be:

a). Lack of empirical research on e-Business (Auramo *et al,* 2002; Golicic, 2002 and Gubi *et al,* 2003).

b). New technology is always praised (Cagliano *et al,* 2005) perhaps until the novelty wears off. There are more advantages than disadvantages to gain from e-Business (Croom, 2005 and Power, 2005a).

c). Lack of understanding and uncertainty regarding e-Business transmits confusing signals for companies to adopt this new technology (Chaffey, 2002 and Nikolaeva, 2006).

Poirier and Bauer (2001) argue that there are four organisational perceptions regarding

the impact e-Business. See Appendix N for the four categories and details. Note that Poirier and Bauer (2001) do not give specific titles for these categories. Poirier and Bauer's views are very favourable towards e-commerce and e-Business. Their argument is based on several assumptions including: businesses and end consumers will change traditional buying habits to new methods facilitated by the Web. This is shown in the first category: *changes occurring in buying habits and the technological advances that are impacting buying and selling relationships, which are moving inexorably towards Web-based features*. According to Delfmann *et al* (2002), assumptions regarding a major shift in consumer-buying habits are yet to be proven.

The empirical studies in this area include Cagliano *et al* (2003 and 2005), Silveira (2003), Iyer *et al* (2004), Croom (2005) and Power (2005a). Silveira (2003) states that companies needs to develop distinctive competencies to achieve the benefits of e-Business. Outlining the importance of distinctive competencies Silveira (2003) states:

> *Their (distinctive competencies) importance in e-Commerce*[13] *is due mainly to the fact that no Internet business is purely virtual; 'real' goods are still being supplied as sold, and 'real' people and installations are needed to support electronic operations* (Silveira, 2003:210).

The competencies relate to three categories: upstream, downstream and structural. Silveira (2003) argues the importance of developing people, technology and facilities under structural competencies. According to Silveira (2003), these competencies are often related and mutually supportive. Iyer *et al* (2004) outline that e-Business[14] contributes to efficient and effective business processes, thus providing benefits such as enhanced time delivery performance, extensive visibility, real-time information, and streamlining processes. Iyer *et al* (2004) claim that e-Business facilitates a responsive SC. Iyer *et al* (2004) also examined effects of environmental and organisational structure on e-Business. They present results indicating that organisational design is an adaptation response to environmental contingencies. Iyer *et al* (2004) suggest that e-Business levels may also be subject to channel factors such as power of trading partners. Cagliano *et al* (2003 and 2005) examined the link between the use of internet tools and

[13] Silveira (2003) considers e-Commerce and e-Business to be the same.
[14] Iyer *et al* (2004) and Power (2005a) refer to e-Business as B2B e-Commerce

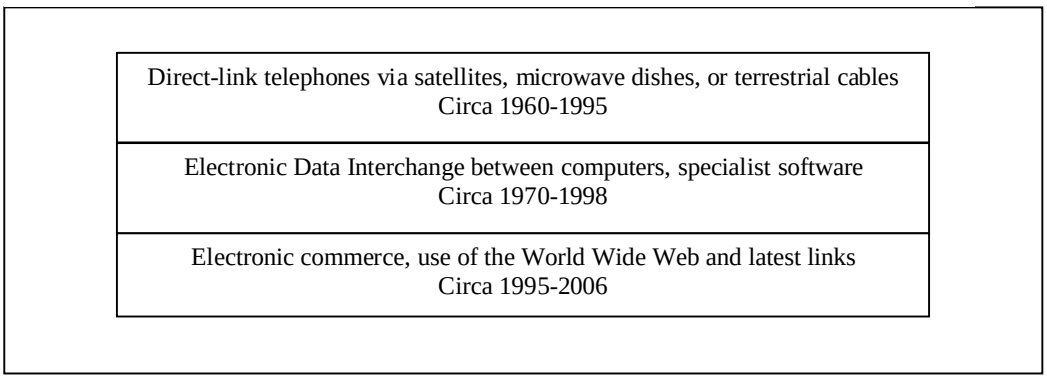
level of integration. Their study identified that internet tools are used for increasing purchasing efficiency rather than integrating inter-firm business processes. Cagliano *et al* (2003 and 2005) outline the need to account for hype in e-Business research. Power (2005a) claims that implementing technology to enable e-Business does not guarantee performance improvement. According to Power (2005a), effective strategy formulation, a clear understanding and knowledge of the technologies, appropriate application, and prudent change management will determine the level of performance achieved by an organisation.

The literature review so far has identified a link between information sharing and BSR. Section three in this chapter provides further discussion on this matter by comparing different methods of information sharing through ICT tools such as VMI, CPFR and Extranets to determine the nature of e-Business. It evaluates the effectiveness of e-Business tools to share information. ICT implementation in SC is discussed next.

2.7.5 Evolution of e-Business in SCM

This section reviews the implementation of communication technology in SCM since the early 1960s. The term 'communication' and its importance to business have been argued by many authors (She *et al*, 2006 and Wilding and Humphries, 2006). For the purpose of this thesis we refer to communications as: *The process by which information is passed between individuals and/or organisations by means of previously agreed symbols* (Little, 1997:2). Authors such as Talluri (2000) and Murillo (2001) outlined the evolution of communications in SCM. See Figure 2.4 for a diagrammatic illustration of three different forms of communications over four decades starting from 1960.

Figure 2.4 Evolution of SCM electronic communication practices



Adapted from: Murillo (2001:371)

See Appendix O for a comparison between the three forms of communication technologies according to speed, cost, quality, quantity, flexibility, and security. According to Murillo (2001), the earliest form of communication in SCM was direct-link telephones via satellites, microwave dishes etc. This method was not exclusive to B2B communications, and was used in B2C and in some households for personal use. The next form of communications to emerge was EDI. This method was designed exclusively for B2B transactions (Adam *et al*, 1999), and this may be a reason why EDI is the most secure method of communication between businesses (Cunningham and Fröschl, 1999 and Nikolaeva, 2006). Power and Simon (2004) identify benefits of EDI to be: reduction in invoice discrepancies and data entry time, improvement in document accuracy, reduced interest costs resulting from earlier payment for goods through the generation of Bills of Lading in electronic format, and increased awareness of technology options leading to new trading partner relationships.

Although EDI is considered as a tool in e-Business, it is not part of Internet technology (Chaffey, 2002). The main difference is that EDI is a dyadic connection whilst the internet facilitates multilateral connection (Power, 2005 and Silveira and Cagliano, 2006). EDI requires dedicated or lease lines to create the connection between two entities (Power, 2005a). Early studies by Kosiur (1997) and Cunningham and Fröschl (1999) claimed that e-Business mainly refers to the Internet and therefore does not include EDI (Adam *et al,* 1999). Similarly, authors such as Adam *et al* (1999) considered that e-Business is mainly Internet based. Since then, this view has changed and EDI is considered a major part of e-Business (Auramo *et al,* 2003; Power and Simon, 2004; Power, 2005a and Silveira and Cagliano, 2006). Outlining the reasons why Internet technology is more popular than EDI, Adam *et al* (1999) argued that:

> *EDI never gained the ubiquitous acceptance that was initially anticipated for it. High costs for initial investment, maintenance costs, or simply lack of preference by potential users kept EDI technologies from developing at a more rapid pace and has traditionally restricted its use to very large corporations*
>
> (Adam *et al*, 1999:1).

Authors such as Cunningham and Fröschl (1999), Min and Galle (1999), Power (2005a) and Silveira and Cagliano (2006) assessed the differences between EDI and Internet commerce. See Tables 2.14 and 2.15 for a comparison of these two forms of

communications. Two differences between traditional EDI and Internet EDI is that the former provides better security and the the latter costs less (Chaffey, 2002 and Schneider and Perry, 2001).

Table 2.14 Traditional EDI vs. Internet commerce

Traditional EDI	Internet Commerce
Predetermined (known) relationships	Ad hoc (unknown) partner relationships
Closed trading community	Open trading community
High volume of transactions	High volume of transactions
High value transactions	Low value transactions
High security levels	Variable security levels
Rigid	Flexible
Primary products and services	Secondary products and services

Source: Cunningham and Fröschl (1999:10)

Table 2.15 A comparison between EDI and the Internet

EDI	Internet
Propriety, dedicated network	Open, ubiquitous network
Highly structured, machine-readable data	E-mail, video, voice, image
High cost	Low cost
More secure	Less secure
Multiple data formates	Universal formats (XML ect)

Source: Min and Galle (1999:915)

According to Kalakota and Whinston (1997), Chaffey (2002), Iyer *et al* (2004) and Power (2005a) the scope of e-Business is far greater than any previous communication facility. Some of the early authors on e-Business such as Kosiur (1997), Cunningham and Fröschl (1999), Min and Galle (1999) and Quayle (2002) made assumptions about the capabilities without empirical research, and argued for the differentiation between e-Business and previous communication methods (See Appendix O).

EDI is mostly implemented by retailers with the aim of achieving collaboration with manufacturers (Moedas, 2006). According to Power (2005a), EDI is viewed as costly and difficult to implement (Lawrence *et al,* 1998) and EDI channels would be replaced by Internet in the near future (Cunningham and Fröschl, 1999). Silveira and Cagliano (2006) suggest that Extranets are replacing EDI technologies because of reasons such as: EDI which works through a value added network (VAN) tends to be expensive to build and maintain, EDI has low flexibility, its batch communication is in standard

format and it requires dedicated systems. According to Silveira and Cagliano (2006), the Extranet provides the privacy and security of EDI but it can work through public networks. Authors such as Croom (2005) and Moedas (2006) also refer to the role of the lead-firm and its influence on technology implementation among other entities in the SC. Supporting this view McIvor and Humphreys (2004) argue:

> *EDI is most appropriate for linking members of a relatively stable community, and in particular a community in which one member is powerful enough to demand adherence to its communication standards*
>
> (McIvor and Humphreys, 2004:243).

According to Power and Simon (2004), in textiles, clothing and footwear (TCF) there is evidence of extensive investment balanced by a perception of little return. Most research on technology adoption seems to cover an intra organisational perspective, discussing internal issues such as managerial support and commitment (Russell and Hoag, 2004). Previous Research on ICT implementation in the apparel industry appears to be survey based or unempirical. A main limitation of using the survey method for this type of study is that it is unable to facilitate in-depth qualitative analysis. Consequently, a survey method is unable to provide an understanding on issues such as relationship power dynamics, commitment and the level of vulnerability. There therefore appears to be a need for further research to identify primary characteristics, level of implementation and evaluation of an ICT tool (Auramo *et al*, 2003; Power and Simon, 2004; Croom, 2005 and Silveira and Cagliano, 2006).

2.7.6 Limitations of previous research on e-Business

The literature review identified several limitations of previous research on e-Business and information sharing. There appears to be a need for further academic research investigating the impact of e-Business on SCM (Lee and Whang, 2001; Murillo, 2001; Van Hoek, 2001; Vakharia, 2002; Gubi *et al*, 2003 and Croom, 2005). Empirical research on information sharing dedicated to e-Business is fragmented (Sahin and Robinson, 2002). Exceptions include: Van Hoek (2001), Vakharia (2002) and Power (2005a). Research studies in this area are largely simulation based or employ a survey method. A summary of previous research and its limitations are presented in Appendix P.

There appears to be a serious lack of research discussing the impact of e-Business on the apparel industry (Christopher *et al*, 2004). Croom (2005) provides some insight on e-Business impact on the apparel industry. Croom (2005) claims that e-Business is providing improved control for the focal company (Beach *et al*, 1998a). According to Croom (2005), the dominant player in the SC may force other members in that SC to implement technologies to achieve integration. Unfortunately, there are no details about the extent to which the dominant player influences technology implementation or in which type of relationship circumstances this takes place. It appears that trust (Baratt, 2004 and Hadjikhani and Thilenius, 2005), interdependence (Sheu *et al*, 2006) and commitment (Humphreys *et al*, 2001) are key variables for successful collaborative relationships. It appears, moreover, that integration is vital to enable collaborative information sharing (Bonet and Paché, 2005; Forman and Lippert, 2005; Power, 2005b and Wilding and Humphries, 2006).

The questions listed next were derived from the literature review. In previous research, these questions were insufficiently answered and/or there is no empirical evidence:

- Who influences the decision to migrate to a new ICT system? (Williams *et al*, 2002; Christopher *et al*, 2004; Croom, 2005 and Moedas, 2006)

- Why do some companies implement new ICT tools to facilitate e-Business? (Power and Simon, 2004; Power, 2005a and Power, 2005b)

- Why do companies believe e-Business adds value to the organisation? (Auramo *et al*, 2002 and Golicic, 2002)

- Why do companies have high expectations of e-Business? (Cagliano *et al*, 2005)

- What are the benefits of e-Business? (Power, 2005a and Shore and Venkatachalam, 2003)

- What criteria can be used to evaluate an ICT tool? (Iyer *et al*, 2004)

- How do current e-Business users position themselves in terms of usage? (Croom, 2005)

2.8 Summary of Section Two

The Internet provides an interconnected platform to use advanced communication tools. The fast changing nature of this technology makes it difficult to establish the capability and the exact impact it has created in business. The literature indicates that there is a high level of hype involved with marketing of e-Business, which makes it even more difficult to understand its true potential. There is disagreement between researchers about the labeling of this technology as e-Commerce or e-Business. This may indicate the level of ambiguity in this area. This section discussed several existing views on the matter of labeling and outlined that for this study communicating through the Internet for commercial purposes is considered as e-Business. Subsequently, available definitions were analysed to establish the parameters for this research. None of the existing definitions appeared suitable to use in this research. Consequently, a definition containing key words relevant to this research was formulated. This section also discussed the scope of e-Business in SCM. The most significant change appears to be the structural changes in the communication channels. This means that the method of disseminating information has shifted from traditional routes to new techniques. According to the literature, ICT tools such as VMI and CPFR provides advanced capability in data sharing compared to previous communication tools. There appears to be many benefits of conducting e-Business. This research aims to investigate four of the advantages stated by Chopra and Meindl (2001). The performance of ICT tools have evolved over several decades. A comparison between EDI and the Internet indicates that the Internet is more flexible and cost effective whilst EDI is more reliable and secure. The literature suggests that e-Business can improve performance through a high level of process efficiency and integration. However, most of the previous research in this area is unempirical and/or incomprehensive. The literature indicates that there is a strong need for research regarding evaluating an ICT tool and the influence of the dominant player on ICT implementation. Specifically, there is limited understanding on the significance of interdependence and commitment in implementing ICT tools.

Section Three - Information Sharing

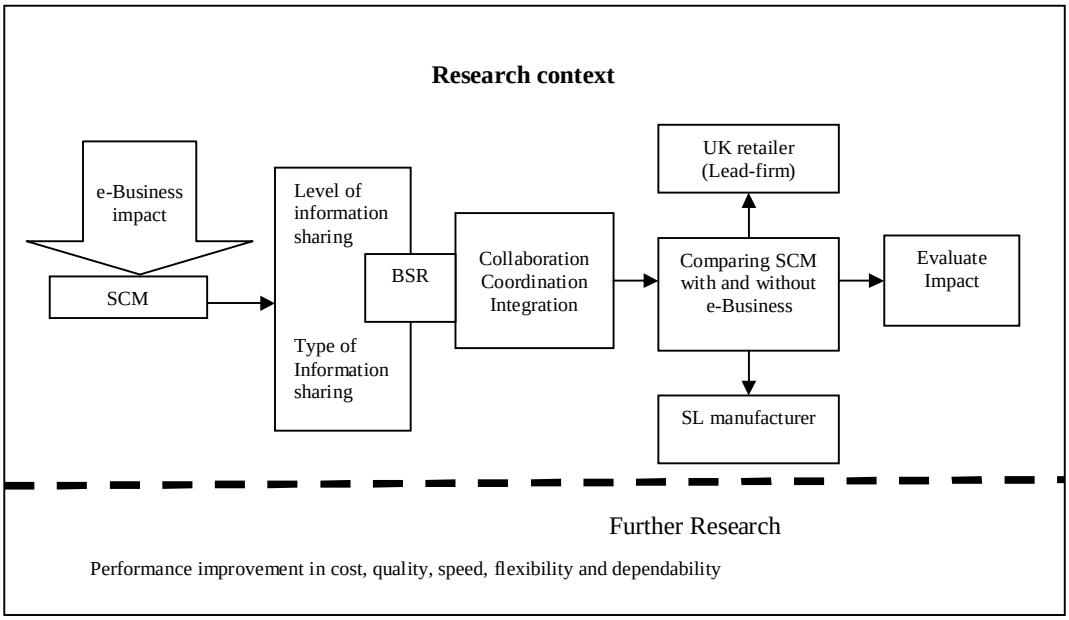
2.9 Introduction

> *Information is a critical resource for organisations, as fundamental as energy for machines. It is the indispensable link that ties all an organisation's components together for better operations and coordination and for survival in an unfriendly competitive environment* (Burch and Gruditski, 1989:3).

Section Two discussed the relative advantages of different modes of information sharing. It was identified that e-Business has greater potential to share information compared to previous ICT tools (Murillo, 2001; Iyer *et al*, 2004; Bajgoric, 2006 and Nikolaeva, 2006). Building on the understanding from previous sections, this section further examines information sharing practices in SCM. The discussion in this section begins by introducing the research context and outlining the research paths. See Figure 2.5 for a diagrammatic illustration of the selected study areas. The research context is set to analyse the impact of e-Business on SCM according to the themes: type of information sharing, level of information sharing, BSR and actual vs. perceived impact. The later part of this chapter proposes a research model based on the literature review. The research model evaluates the four themes to establish attributes relevant to this study.

Authors such as Kalakota and Whinston (1997), Quayle (2002), Christopher *et al* (2004), and Croom (2005) claim that e-Business impacts on SCM in different ways according to the particular industry. The present study investigates the apparel industry information sharing practices facilitated by e-Business. The benefits of e-Business proposed by authors such as Van Hoek (2001), Quayle (2002), Croom (2005) and Power (2005a) are empirically tested. Section One identified the importance of BSR and information sharing for collaboration (Bonet and Paché, 2005 and Sheu *et al*, 2006). In Section Two it was identified that authors such as Lee and Whang (2001), Christopher *et al* (2004), Caputo *et al*, (2005) and Todeva and Konke (2005) claim that e-Business is able to provide the required level of integration to practise information sharing as an essential part of collaborative partnerships.

Figure 2.5 Research areas and path



Information sharing practices can be regarded as centralised or decentralised coordination in SCM (Zhao *et al*, 2002; Disney and Towill, 2003 and Wanke and Zinn, 2004). Coordination means dissemination of information for inventory control such as a 'push' or 'pull' system (Beach *et al*, 1998a and Slack *et al*, 2001). The centralised approach is controlled by a single entity seeking to optimise the network (McIver and Humphries, 2004). Usually the lead firm assumes this task (Slack *et al*, 2001; Williams *et al*, 2002; Fawcett *et al*, 2005 and Moedas, 2006). A decentralised approach seeks to act in the best interest of the individual supply chain members. According to Lee and Whang (1999), current management practice reflects a decentralised approach. Often, decision makers have private information, which they may not share with others, resulting in sub-optimal system performance (Cox *et al*, 2004 and Christopher, 1998). To overcome this problem, supply chain contracts are used (Lysons and Gillingham, 2003). Contracts ensure coordination through appropriate provisions for information and incentives so that the SC is optimised to the best possible level (Swaminathan *et al*, 1995). This area is related to benefits sharing, a 'buzzword' at the time in SCM research (Lysons and Gillingham, 2003). It appears that literature in this area does not discuss specific details about a policy that can be used when sharing sensitive information, rather they suggest that it should be practised based on trust and commitment.

The research aims to identify the impact created by ICT tools such as EDI to enable

VMI and CPFR. Subsequently, this section evaluates the effectiveness of ICT tools compared to previous methods. The main benefit of e-Business tools such as EDI, CPFR (Holmström *et al*, 2002; Iyer *et al*, 2004 and Min *et al*, 2005) and VMI (Disney and Towill, 2003; Smäros *et al*, 2003 and Sheu, 2006) compared to previous technology such as direct link telephones or fax is that e-Business is able to provide integration (Auramo *et al*, 2005) and coordination (Christopher *et al*, 2004). According to Shore and Venkatachalam (2003), two parameters essential for integration and coordination are collaboration and information technology.

It appears that empirical research on information sharing is fragmented. The inclusion of the BSR dimension in the research therefore adds a distinguishing feature compared to previous studies. The literature review in the second section identified that BSR is key to achieving collaboration. This section aims to establish key factors linking buyer-supplier relationships (BSR) and information sharing. Section One discussed the theme of BSR according to issues such as types of relationship (i.e. required for sharing strategic information) and the lead firm. It was established that types of relationships are determined by the level of commitment (Humphreys *et al*, 2001; Cigolini *et al*, 2004 and Fawcett *et al*, 2005) and dependence (Lambert and Stock, 2001 and Svensson, 2002b) between two or more entities. This section will further develop discussion on the complex areas of commitment and dependencies to understand issues such as information transparency between entities. This is undertaken by reviewing the model by Swaminathan *et al* (1995). Section 2.10.2 discusses Swaminathan *et al*'s (1995) model.

Hamel (2000) recognised the need for closer relationships within SC, mainly to facilitate the sharing of competitive information. Harland *et al* (1999) and Cousins (2005) argue a positive correlation between information sharing and BSR and contended that BSR is a critical factor for a long distance international SC (Guercini and Runfola, 2004). The main limitation of the study by Harland *et al* (1999) is the methodology. Their study is based on 'quasi-Delphi' method, which is limited to the views of a small panel of people from a senior executive level. The purpose of Harland *et al*'s (1999) study was to develop future supply strategies through visionary idea generation. This article identifies several important issues regarding international supply chains and future supply chain practice but appears to be ambitious in developing a common supply strategy for a cross section of industries from transportation, defence,

food, financial services and entertainment.

An area suitable for further research is identified as the link between information sharing, BSR, and performance improvement. Previous research by Hayes and Wheelwright (1984) and Beach *et al* (1998a) considered the correlation between information sharing and performance but failed to incorporate BSR in the equation. The researcher recognises the link between these three areas but does not plan to pursue this path due to several reasons such as the difficulty in obtaining performance related data, reliability of data, and the scale of research involved.

2.10 Coordination

Wanke and Zinn (2004) argue that there are three strategic level decisions involved with inventory management: make to order vs. make to stock, push vs. pull inventory deployment, and centralised vs. decentralised. Push vs. Pull inventory systems are discussed in more detail in this section to review the claim that e-Business provides improved capabilities for inventory management. A supply chain is fully coordinated when all decisions are aligned to accomplish overall system objectives (Harland *et al*, 1999 and Closs *et al*, 2005). According to Simatupang *et al* (2002) the basic dimension of coordination is the sharing of private information between two or more parties. Sahin and Robinson (2002) argue that lack of coordination happens when decision makers have incomplete information or incentives that are not compatible with system-wide objectives (Cox *et al*, 2004). Simatupang *et al* (2004) argue that the effectiveness of a coordination mechanism depends on a shared view of the coordination structure, because it facilitates visibility of the interconnection between individual responsibilities and their interrelationships to achieve original objectives. Lee and Whang (2001) contend that, even under conditions of full information sharing, SC performance can be sub-optimal if all decision makers optimise their individual goals (Cox *et al*, 2004). For example, the retailer may not consider the suppliers' profit margins when ordering stock (Bonet and Paché, 2005). Todeva and Knoke (2005) contend that new cooperate arrangements based on strategic alliances seek to achieve organisational objectives through collaboration rather than through competition. It is interesting to understand to what extent companies are willing to ignore confidentiality and security for the benefit of coordinating the system. According to Hadjikhani and Thilenius (2005), trust and

commitment are vital for success in this type of scenario.

2.10.1 Push and Pull systems

Section One of the literature review identified that a key task of SC is planning and control (Lambert and Stock, 2001). SC 'control' monitors the planned activities and rectifies any deviations that may occur due to internal and external influences (Waller, 1999). The two main methods of intervention (i.e. control) are the push system of control and the pull system of control (Slack *et al*, 2001). Krajewski and Ritzman (1993) discuss the push and the pull system as the two basic disciplines that govern the flow of material in the SC. Beach *et al* (1998a) refer to the push and pull system as the anticipatory SC and response-based SC respectively. Wanke and Zinn (2004) argue that inventory control is specific according to product, operational and demand variables. Appendixes Q represents a diagrammatic illustration of push and pull SC. The difference between the two methods is that the push SC works through the processes pushing stock to the next echelon, and the pull SC works through the processes only moving stock when required by the next echelon (Krajewski and Ritzman, 1993). Technology such as VMI (Disney and Towill, 2003 and Sheu *et al*, 2006) and CPRF (Holmström *et al*, 2002; Larsen *et al*, 2003; Iyer *et al*, 2004 and Min *et al*, 2005) is capable of facilitating a push system of control and cross-decking technologies are capable of facilitating a pull type of control. Authors such as Smäros *et al* (2003) argue that a key benefit of VMI is that it improves visibility of the production and inventory and therefore improves efficiency. This research argues that the type of technology application for inventory control is an indication of the level of e-Business usage. A main aim of this research is to identify the level of e-Business utilisation by apparel manufacturers in Sri Lanka.

In a push system of control, each workstation (echelon) pushes out inventory without considering whether the succeeding workstation can make use of it (Waller, 1999). The workstations are controlled by the lead firm in the SC (Moedas, 2006). Slack *et al* (2001) contend that idle time, inventory and queues often characterise the push system. Theodore *et al* (1997) argue that in a push SC, dealing with out-of-stock situations and/or excessive inventory build-up of less popular products components is often a recurring problem. In a pull system the following echelon sets the pace and specification of passed on inventory. In other words, the following echelon triggers the material

movement. If a request is not passed back to the previous echelon, that workstation cannot produce anything or move any materials. In this way, the original customer transmits demand back through the stages from the original point of demand (Beach *et al*, 1998a; Waller, 1999 and Slack *et al*, 2001).

Beach *et al* (1998a) argue that companies can take advantage of new information technology and practise inventory management through a response-based or pull system of control (Birtwistle *et al*, 2006). Promoting the benefits of a response-based system, Beach *et al* (1998a) advocate that replacing inventory with information will enable effective logistics execution, delivering lower costs to each firm involved in the supply chain (Bruce *et al*, 2004). From their research, Beach *et al* (1998a) concluded that 1) information integration reduces risks posed by demand uncertainty, 2) A response-based supply chain performs significantly better, reducing total SC inventory levels by 25 percent compared to anticipatory or push supply chain (Guercini and Runfola, 2004 and Lowson, 2005).

It appears that integrated management through information sharing can improve supply chain inventory management performance (Scott and Westbrook, 1991; Byrne and Javad, 1992; Daugherty, 1994; Gustin *et al*, 1994; Bowersox and Closs, 1996; Disney and Towill, 2003 and Smäros *et al*, 2003). Illustrating the benefits of information integration, Lee and Whang (2001) contend that by using electronic communications, information distortion, also known as the bullwhip effect, in the SC can be reduced, enabling firms to avoid excessive inventory build-up.

According to Gary (1995) and Pires *et al* (2001) the most common information based inventory management systems include vendor-managed inventory (VMI), continuous replenishment programmes (CRP), and more recently the automatic replenishment program (ARP) (Beach *et al*, 1999). The more industry specific programmes include efficient customer response (ECR) and quick response (QR) in the apparel industry (Chandra and Kumar, 2000). Bruce *et al*, (2004) argue the importance of relationships for practising QR in order to achieve a lean SC in the apparel industry. They suggest that the textiles and clothing market has characteristics, such as short product lifecycles, high volatility, low predictability, and a high level of impulse purchase, that makes an approach like QR of paramount importance (Christopher, 1998; Christopher *et al*, 2004 and Lowson, 2005). Appendix R illustrates lean retailing apparel SC. The difficulty of

developing trust and commitment for close buyer-supplier relationships is often cited as the primary reason that firms ignore the obvious benefits of information based inventory management (Beach *et al*, 1999 and Silveira and Cagliano, 2006). Over recent years, research on buyer-supplier relationships has increased, responding to a lack of empirical knowledge on the subject. Based on empirical evidence, authors such as Cox *et al* (2004), McIvor and Humphreys (2004), Simatupang *et al* (2004) and Staughton and Johnston (2005) advocate the importance of trust, commitment and interdependence, underlining that buyer-supplier relationships have moved from an adversarial to a partnership approach. This appears to have impacted on operational, transactional and strategic levels in an organisation. At the operational level, buyer-supplier relationships affect issues such as organisational capability, risk and uncertainty in relationships (Ford *et al,* 1998) and managing relationships (Ellram and Edis, 1996 and Ford *et al*, 2003). At a transactional level, activities such as negotiations are changing from a situational to institutional approach (Ertel, 1999 and Fynes *et al* 2005). As a result, the types and nature of relationships are observed more keenly by organisations. At a strategic level, focus is given to adding value from long-term relationships (Zsidisin and Ellram, 2001).

2.10.2 Information sharing model

This section reviews the argument that information sharing provides a positive impact on SCM performance by discussing a model developed by Swaminathan *et al* (1995). Swaminathan *et al* (1995) introduce three simulation models focusing on sharing information on production capacity between two suppliers, a manufacturer and a retailer. See Appendix S for a diagrammatic illustration of this model. This comprehensive model (combination of the three simulation models) is an extension of their earlier research (Swaminathan *et al,* 1994). Outlining the reason for choosing production capacity as the context of their research the authors state:

> *The capacity that a supplier allocates to a manufacturer is not constant over time and depends on factors such as demand faced from other manufacturers, real-time machine breakdown at the factory, priority assignments to the particular manufacturer etc. The manufacturer faces uncertainty about the supplier's capacity allocation while reordering goods.* (Swaminathan *et al*, 1995:6)

Model by Swaminathan *et al* (1995)

Scenario

Swaminathan *et al* (1995) consider the scenario with four entities (i.e. retailer, manufacturer and two alternative suppliers). The two suppliers differ in terms of cost, quality of service as well as the capacity allocations (supplier 1 is less expensive than supplier 2). By integrating supplier information and decision processes of the manufacturer the researchers analysed the effect on the cost incurred and quality of services provided by the supply chain (i.e. cost and quality are two SCM performance measures).

Details of the models

Model I – The suppliers and manufacturer share only average allocation figures. No dynamic information sharing

Model II – The suppliers are more closely linked with the manufacturer and are willing to provide their current capacity allocations

Model III – Only supplier 1 closely shares information with the manufacturer and supplier 2 shares only average allocation figures (limited information sharing).

According to Swaminathan *et al* (1995) the results indicated that information sharing has a significant effect on the performance of different entities in the supply chain. The manufacturer incurs a lower cost when information is shared (Model II) as compared to operating under assumptions about capacity (Model I). This could be a reason why the manufacturer (dominant player) influences other members to implement technology (Croom, 2005).

From the simulation, Swaminathan *et al* (1995) reported that information sharing reduces the total cost incurred in the SC, improves the quality of services, and increases the profits of supplier 1. This is similar to the view of Beach *et al* (1998a), discussed under the 'push and pull' model in Section 2.10.1.

Interestingly, the results indicated that the profit of supplier 2 in model II is significantly reduced. The competitive advantage of supplier 2 (i.e. its ability to deliver the goods more reliably than supplier 1) is lost in model II because of the information transfer that occurs between the manufacturer and the suppliers. The manufacturer has full information on the capacity allocations before making the ordering decision and uses the information effectively to reduce its costs and provide better services. Defending the finding from their research Swaminathan *et al* (1995) state:

> *The less expensive supplier would be inclined to share the information once the advantages are explicitly stated and the more expensive supplier may not be willing to share information. However supplier 2 (*more expensive) *has no control over whether supplier 1 decides to share capacity information.*
>
> (Swaminathan *et al*,1995:7)

In model III they found that supplier 2 under the scenario of not sharing information makes an even lower profit than in model I. They further suggest that in such a situation, Japanese automakers like Nissan and Toyota often develop the weaker of the two suppliers by helping them to improve production processes. Similarly, many academics believe that supplier development is a key component of SCM (Sako, 1992; Swaminathan *et al*, 1995; Leonidou and Kaleka, 1998; Håkansson and Gadde, 2001; Fynes and Voss, 2002 and Fynes *et al*, 2005).

However, Swaminathan *et al*'s (1995) model is not immune to criticism:
1). The profit levels of suppliers in model I are not clearly discussed. In line with the rest of the findings, the authors argue that profit levels of both suppliers are equal in model I.

2). These models consider only four entities. In a practical setting, a supply chain may involve multiple echelons and the impact of information sharing would be more complex and difficult to measure (Beach *et al*, 1998b). For instance, each echelon is interdependent (Lysons and Gillingham, 2003 and Simatupang *et al*, 2004) and sharing information by suppliers and manufacturer will affect the other echelons (Pires *et al*, 2001; Van der Vorst, 2002 and Mills *et al*, 2004). This would complicate measuring the exact cost reduction and overall service improvement in the SC.

3). In the given scenario, information on the manufacturer is not shared. The manufacturer is the lead firm or the 'central operations planning and control' (Slack *et al*, 2001 and Fawcett *et al*, 2005). In practical setting, suppliers are likely to demand information transparency from the manufacturer if they themselves are required to divulge strategic information (Power, 2005b). This is not discussed by Swaminathan *et al* (1995).

4). The balance of power between supplier and manufacturer (Svensson, 2002b) will depend on the nature of the product (Wanke and Zinn, 2004) (i.e. technical, specialist knowledge, patent, etc) and the available number of suppliers (Barnett, 1996; Harland *et al*, 1999 and Macbeth, 2002). Swaminathan *et al* (1995) do not consider this aspect in their research.

5). The information technology used in this research is Electronic Data Interchange (EDI). This research was carried out in 1995. At that time, electronic communications (in particular e-Business in the B2B sector) were not widely available (Adam *et al*, 1999; Cunningham and Froschl, 1999 and Chaffey, 2002). The capabilities of EDI are lower than that of new methods such as extranets (Silveira and Cagliano, 2006). The researcher argues that if multilateral electronic network communications (ENC) are used instead of EDI (Power, 2005b and Silveira and Cagliano, 2006), the simulation model could have included more SC entities, as ENC is able to transfer information to several entities in real time. For example, if ENC were used, suppliers could have communicated with the retailer (demand generator) directly, to understand the requirements of the manufacturer. By doing this, the balance of power between the suppliers and the manufacturer would be less unequal (Svensson, 2002b).

2.11 Previous research on information sharing

Information sharing has been a topic of research interest for many years (Murillo, 2001). There is heightened interest in this area because of developments in ICTs tools such as vendor managed inventory (VMI) and collaborative planning forecasting and replenishment (CPFR) (Disney and Towill, 2003 and Larsen *et al*, 2003). This is because they provide more capability to communicate and share information (Vakharia, 2002 and Power, 2005a). As depicted in Figure 2.5, each decade since the 1960s has presented new ways of sharing information. The ability to share information with

strategic partners gives many advantages (Bowersox and Closs, 1996; Closs *et al*, 2005 and Li *et al*, 2005). Shore and Venkatachalam (2003) contend that it is difficult to identify a supplier's collaborative potential, stating:

> *While a supplier can certainly be asked about the willingness to co-operate, receiving a reliable and useful answer may be difficult, especially if the supplier is from a different culture where interpretations of questions and responses may have different meanings* (Shore and Venkatachalam, 2003:5).

Shore and Venkatachalam (2003) propose the following criteria to measure infrastructure capability for information sharing:

- Hardware capability
- Software capability
- Network capability
- Data management capability

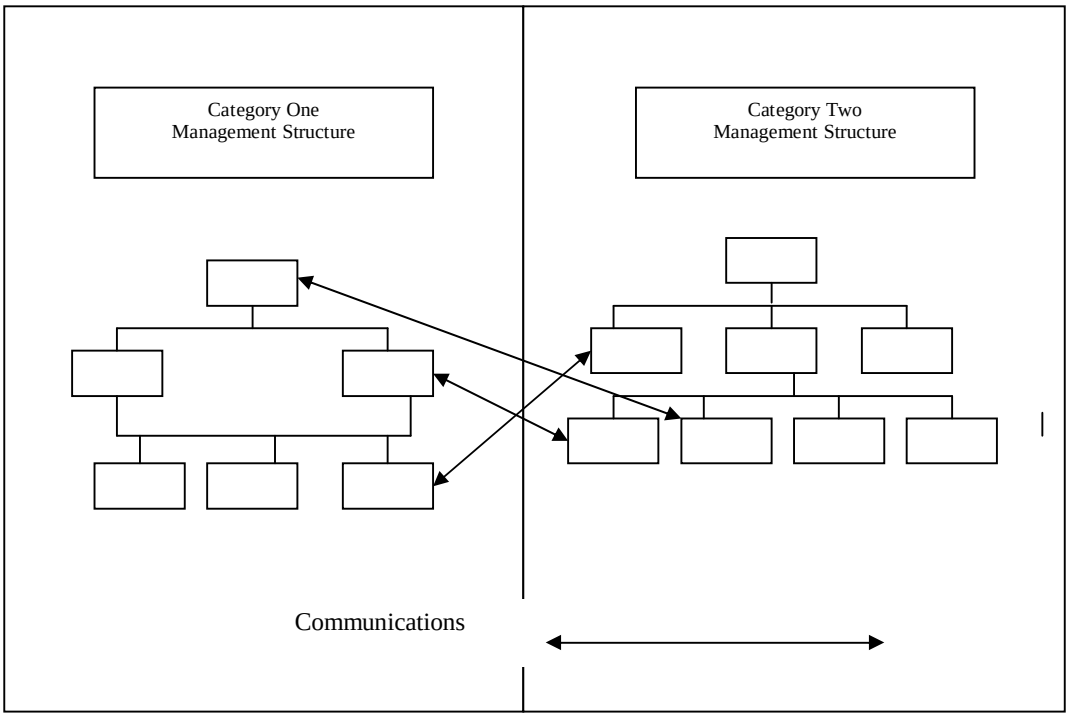
Mentzas (1993) and Walsham (1993) discuss the following attributes to measure the level of information sharing using ICT tools:

I. Frequency of information shared – how often do they communicate and share information?
II. Quantity of information per (average) message, - small amounts regularly or a large amount irregularly?

III. Accessibility of information – technical capability of assessing the required information (i.e. large files, images). This research postulates that the ability to access information will motivate employees to share more information.

IV. Cross structural communication: are they able to communicate with different structural levels in the buyer's organisation? (See Figure 2.6).

Figure 2.6 Cross-structural communications



There are three types of information operating in SCM: strategic, operational and transactional (Slack *et al*, 2001). At the operational level, new ICT tools are used for maintaining routine activities such as inventory control, replenishment, and production scheduling (Disney and Towill, 2003). According to Disney and Towill (2003), VMI comes in many different forms. Some of these are QR (Hammond, 1990 and Perry *et al*, 1999), accurate response (AR) (Hunter, 1990 and Hunter and Valentino, 1995), and ECR (Clark and McKenney, 1995 and Cachon and Fisher, 2000). The main focus of AR and QR is to reduce the manufacturer's lead-time (Chandra and Kumar, 2000). QR is mainly used in short sales season environments like the apparel industry (Hammond, 1990). QR is concentrated on the retail side of the SC and companies such as J.C. Penny and Wal-Mart currently use this system. ECR is mainly used in the grocery industry: Kurt Salmon Associates (1993) projected a potential $30 billion in supply chain savings from implementing ECR strategies. There is some research which suggests that new ICT tools reduce inventory costs and improve efficiency through avoiding the bullwhip effect (Lee and Whang, 2001). A comparison study, of two SCs, one equipped with VMI, the other without, indicated performance benefits for the SC using VMI (Lee *et al*, 1997a). The second type of information is transactional information, used for activities like electronic point of sale (EPOS) data (Slack *et al*, 2001). With EPOS the

manufacturer receives the early sales data and utilises it to increase forecast accuracy and fine-tune his production schedules (Sahin and Robinson, 2002). The third type of information is strategic, mainly used for coordinating the SC and managing a long-term strategic view (Swaminathan *et al,* 1995). This research aims to identify the impact of e-Business on sharing different types of information in the apparel SC.

The emergence of the Internet has created a platform to employ ICT tools such as VMI. This makes understanding BSR important because of the potential benefits associated with open system protocol (McIvor and Humphreys, 2004:241). In other words it appears that information sharing policy between entities are dependent on the status of their relationship. This suggests a close link between the two themes of BSR and information sharing. Early research in SCM by authors such as Stevens (1989), Byrne and Javad (1992), Daugherty *et al* (1992), Gustin *et al* (1994) and Emmelhainz (1996) identified the benefits of information sharing. These authors observed a holistic view of the SC and argued that each member within the SC should coordinate operations through total information sharing in order to achieve overall system objectives. However, at that time (i.e. late 1980s to mid 1990s) the technological capability for sharing information was limited (Shore and Venkatachalam, 2003). This may be the reason why academics were unable at the time to test their hypotheses empirically and build a comprehensive argument. For example, Bowersox and Closs (1996) argue the benefits of information integration but fail to identify the problems and complexities involved, such as supplier exposure, lead firm dominance, and benefit sharing. With the emergence of e-Business, the capabilities and benefits argued by these academics can now be empirically tested.

According to Sahin and Robinson (2002), academic research in this area can be divided into three categories: (I) no information sharing and no coordination, (II) partial/full information sharing and no coordination, and (III) full information sharing and complete coordination. The first category (i.e. no information sharing and no coordination) includes research by Forrester (1958), Sterman (1989), Lee *et al* (1997a), Lee *et al* (1997b), Metters (1997), Baganha and Cohen (1998), Cachon (1999), Taylor (1999), Chen *et al* (2000), Fransoo and Wouters (2000) and Cox *et al* (2004). The majority of these studies focus on information distortion within the supply chain. Broadly they argue, without information sharing and coordination, demand variability would be amplified in the SC and each echelon would maintain extra safety stock.

These authors argue the importance of information sharing and contend that coordination decreases demand variance amplification and reduces cost.

Authors belonging to the second category (i.e. partial/full information sharing and no coordination) include Swaminathan *et al* (1995), Hariharan and Zipkin (1995), Bourland *et al* (1996), Fisher and Raman (1996), Iyer and Bergen (1997), Beach *et al* (1998a), Gavirneni *et al* (1999), Gilbert and Ballou (1999), Chen *et al* (2000), Lee *et al* (2000) and Chen *et al* (2001). These studies mainly focus on capacity utilisation with information sharing as a countermeasure to the bullwhip effect. In general, these studies investigate the benefits of partial and full information sharing without coordinated decision-making. They discuss a variety of issues including supply chain structures, information sharing strategies, replenishment strategies, and research methodologies. For example, Gavirneni *et al* (1999) estimate cost savings of on average of 50 percent when moving from a non-information sharing to a partial information sharing environment. Broadly these studies conclude that information sharing alone does not eliminate the bullwhip effect and argue that coordination among retail partners is also required. This research draws particularly on the research by Swaminathan *et al* (1995) which focused on different levels of information sharing.

The third category (i.e. full information sharing and complete coordination) includes research by authors such as Anand and Mendelson (1997), Parlar and Weng (1997), Chen (1998), Waller *et al* (1999), Cachon and Fisher (2000), Donohue (2000), Chen *et al* (2001), Fisher *et al* (2001), Frohlich and Westbrook (2001) and Fry *et al* (2001). They argue the importance of information sharing and coordination for performance improvements. Similarly to the views of Hayes and Wheelwright (1984) and Harland *et al* (1999), these authors recognise a positive link between information sharing and performance improvement.

The three categories mentioned above outline the evolution of research on information sharing in SCM. The first category is focused on understanding the complexities of supply chain management including information distortion and the bullwhip effect. The second category emphasises information sharing as a solution to supply chain problems, and the third category outlines the effects of coordination and information sharing to improve performance. The present research pays particular attention to the second (i.e. information sharing with no coordination).

The main limitation of previous studies is the methodology they have adopted. The majority of these studies are simulation-based. Assumptions required for simulation hamper understanding the true nature of SC in several ways: (I) the research context is only based on two to three echelons SC; (II) environment complexities such as out of stock, shipment delays and communication difficulties are ignored. This study argues that by using simulation the true nature of the SC is not fully understood, as research is carried out in a predetermined, controlled environment rather than an actual operating environment. There is an abundance of simulation based quantitative research (mainly from USA universities) on information sharing in SCM. However, there appears to be limited qualitative research in this field.

The distinguishing factor of this research from previous studies is that this PhD study does not investigate information distortion specifically. In this study, information distortion is observed under the theme of level of information sharing according to the attributes mentioned by Mentzas (1993) and Walsham (1993). The other distinguishing factor is that most of the previous research appears to be simulation based modelling while this research is empirically based. The questions listed below were derived from the literature review.

- How important is information sharing in the apparel SC? (Christopher *et al*, 2004 and Birtwistle *et al*, 2006)

- What are the negative aspects of information sharing, if any? (Swaminathan *et al*, 1995 and Simatupang *et al*, 2004)

- Who controls the information sharing policy? (Fawcett *et al*, 2005 and Moedas *et al*, 2006)

- How can suppliers preserve competitiveness in a total information transparency SC? (Swaminathan *et al*, 1995 and Hadjikhani and Theilenius)

- What type of information sharing policy do they use?

2.12 Summary of section three

This section introduced the research context and identified the area investigated by this study. The discussion in this section is dominated by two models: push and pull inventory systems (Beach *et al*, 1998a and Slack *et al*, 2001) and the information sharing model by Swaminathan *et al* (1995). Both the models identified the opportunities and implications for sharing information and performance improvement. The literature review also indicated that a main problem with information based inventory management is that it requires information transparency and close buyer-supplier relationships (Simatupang *et al*, 2004). It appears that a basic requirement of SCM is to develop buyer-supplier relationships in order to coordinate the SC strategically (Closs *et al*, 2005; Power, 2005b and Sheu *et al*, 2006). This issue is a main focus in the research.

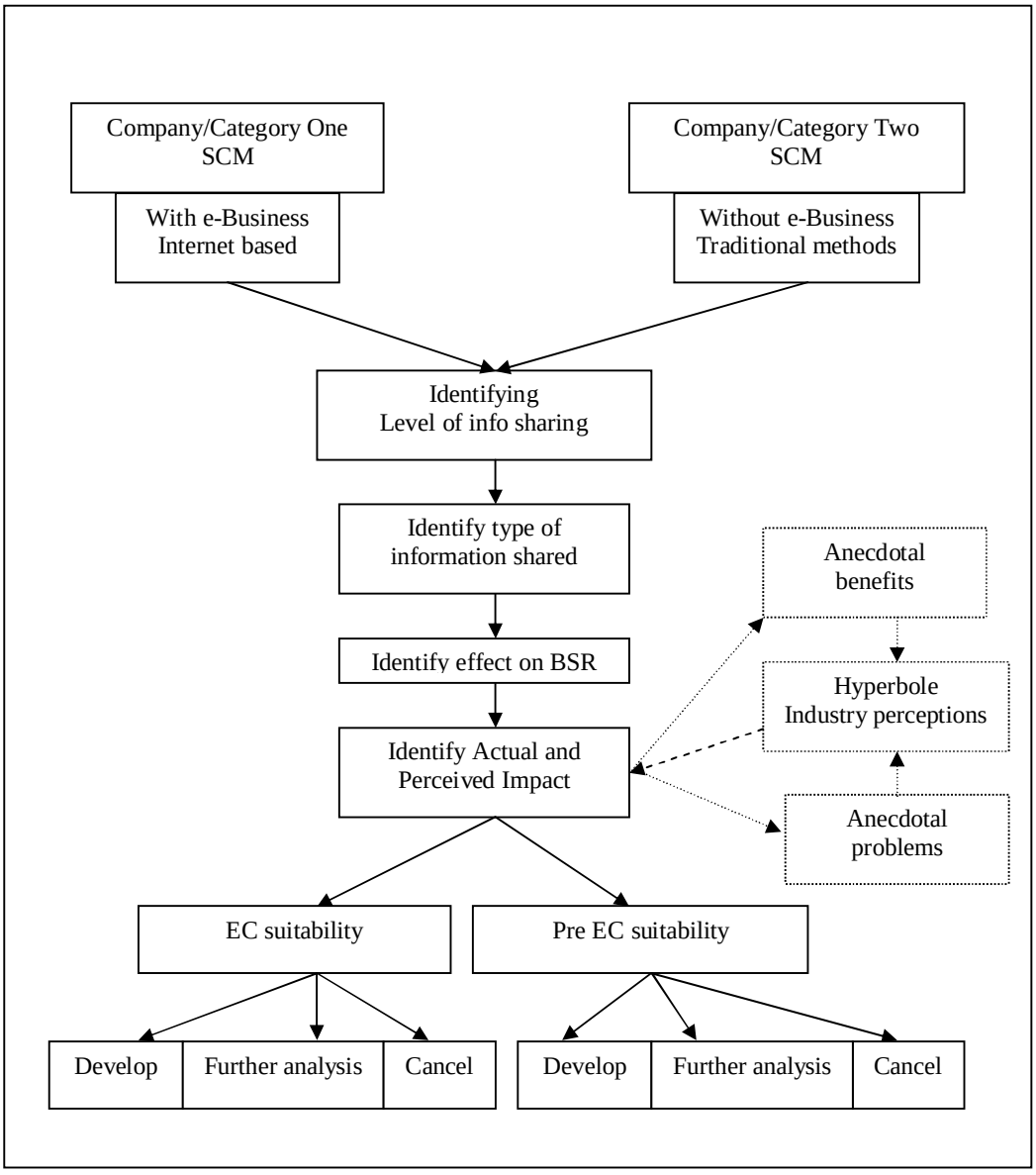
The review of push and pull models indicated that SCs should take advantage of information sharing technology and practise a pull or response based system (Disney and Towill, 2003). The literature review suggests that there is substantial evidence to suggest that information integration improves inventory management performance in the SC (Silveira and Cagliano, 2006). Through information sharing, the SC can reduce cost of inventory (i.e. avoid excessive build-up of unpopular products/components, stock-outs and reduce demand uncertainty) and improve service (Lowson, 2005).

The information sharing model by Swaminathan *et al* (1995) was used to discuss the impact of information sharing in a SC. The model indicated that information-sharing exposes the weaknesses of suppliers and favours the more capable supplier (Svensson, 2002b and Fawcett *et al*, 2005). From a manufacturer's (dominant actor) perspective, this is an ideal situation as advantage can be taken of the situation by allocating orders to the more capable supplier (cheaper) and perhaps develop the weaker supplier for future benefit. However, it is interesting to see whether in practice, suppliers are willing to share strategic information without long-term commitment from the manufacturer, especially if they are required to improve their capability.

2.13 Research focus

This study aims to investigate claims about the impact of e-Business on SCM by comparing a supply chain with e-Business to a supply chain without e-Business. See Figure 2.7 for a diagrammatic illustration of the research model. The literature review was based on four themes: 1. level of information sharing, 2. type of information sharing, 3. BSR and 4. actual vs. perceived impact. The configuration of the research model reflects the interrelationship between the themes.

Figure 2.7 Research Process



2.13.1 Comparing SCM with e-Business to SCM without e-Business

At the first level the model is split in to two sides according to SCM with e-Business and SCM without e-Business. Section two of the literature review discussed the anecdotal claims made about e-Business and the need for empirical research. A comparison is made between the two categories of firms to answer the following questions:

- Why do some companies implement new ICT tools to facilitate e-Business?
- Why do companies believe e-Business adds value to the organisation?
- What are the benefits of e-Business?
- How do current e-Business users position themselves in terms of usage?

2.13.2 Identify the level of information sharing

The second level attempts to identify different levels of information sharing according to the two technology categories. This is evaluated according to the attributes discussed by Mentzas (1993) and Walsham (1993). The attributes are as follows:

1. Quantity of information
2. Communication platform integration
3. Accessibility of information
4. Cross structural visibility

The research will identify a broad picture of the quantity of information exchanged (i.e. high, medium, or low). Authors such as Fawcett and Magnan (2002), Caputo *et al* (2005), Cagliano *et al* (2006) and Gulledge (2006) argue that it is possible to integrate the SC with new types of ICT tools. This claim will be empirically tested in this research. According to Delfmann *et al* (2002) the literature arguing the negative aspects of e-Business is sparse. Accordingly, this research plans to identify whether there are negative aspects of e-Business due to information sharing. One negative aspect identified from the literature is that weaker suppliers are exposed in a total information transparency SC (Swaminathan *et al*, 1995). According to Christopher (1998), companies are reluctant to share information freely, and usually prefer a ‘need to know

basis' policy. It is interesting for this research to identify the accessibility of information between two or more entities. The fourth attribute aims to identify the affect on visibility due to ICT tools such as VMI and CPFR (Disney and Towill, 2003 and Simatupang *et al*, 2004).

This theme will attempt to answer the following questions:

- How can suppliers preserve competitiveness in a total information transparency SC?
- What are the negative aspects of information sharing, if any?
- What type of information sharing policy do they use?

2.13.3 Identify the type of information sharing

The ICT tools used in a SC determines the type of information shared in that SC (Croom, 2005). The strength of BSR plays a crucial part in accessing different types of information (Leonidou and Kaleka, 1998 and Todeva and Knoke, 2006). Information in a SC can be categorised as: operational, tactical and strategic (Slack *et al*, 2001). Christopher *et al* (2004) argue the importance of information shared in the apparel SC as it has characteristics such as high volatility, low predictability, and a high level of impulse purchase. This research aims to understand which types of information are shared in the apparel SC between the retailer and the manufacturer (Lowson, 2005).

This theme aims to answer the following question:

- How important is information sharing in the apparel SC?

2.13.4 Buyer-supplier relationships

The literature suggests that this theme is linked to the previously discussed two themes. According to authors such as Quayle (2002), e-Business is restructuring SCM operations and relationships, to take advantage of better information flows. The leadership and governance (Williams *et al*, 2002 and Fawcett *et al*, 2005) of the SC

appears to be important for achieving collaborative relationships (Barratt, 2004; Bonet and Paché, 2005; Todeva and Konke, 2005; and Simatupang and Sridharan, 2005; Sheu *et al*, 2006 and Wilding and Humphries, 2006) and the level of influence for technology implementation by a dominant player (Croom, 2005). This research aims to understand the lead firm's (UK retailer) role in implementing ICT and managing information flows. This will be subject to the views of Sri Lankan garment manufacturers.

The findings may be of particular interest, as the researcher has not found comprehensive research on implementing ICT and managing information flows in a similar context to date. The findings may also be applicable to other apparel SCs between developed and developing economies such as Europe and South East Asia, and the USA and South America. This study may reflect practices of other labour intensive industries such as automotive or electronic. This theme aims to answer the following questions:

- Who influences the decision to migrate to a new ICT system?
- Who controls the information sharing policy?

2.13.5 Identify actual and perceived impact

This stage will empirically identify the impact of e-Business. Authors such as Adam *et al* (1999) and Cagliano *et al* (2005) noted the publicity surrounding e-Business and argued that research in e-Business should disregard hyperbole for a better understanding. This theme will attempt to answer the following questions:

- Why do companies have high expectations of e-Business?
- What criteria can be used to evaluate an ICT tool?

According to authors such as Bruce *et al* (2004), Christopher *et al* (2004), and Guercini and Runfola (2004) the majority of Western apparel retailers outsource the manufacturing function to developing countries. This research argues that a better understanding of the research context may encourage further trade between UK and Sri

Lanka and provide apparel manufacturers with clearer answers on ICT suitability for their SCs. Most importantly, this study aims to contribute knowledge to the field of e-SCM by identifying the capabilities and limitations of e-Business, and its impact on SCM.

CHAPTER 3 METHODOLOGY

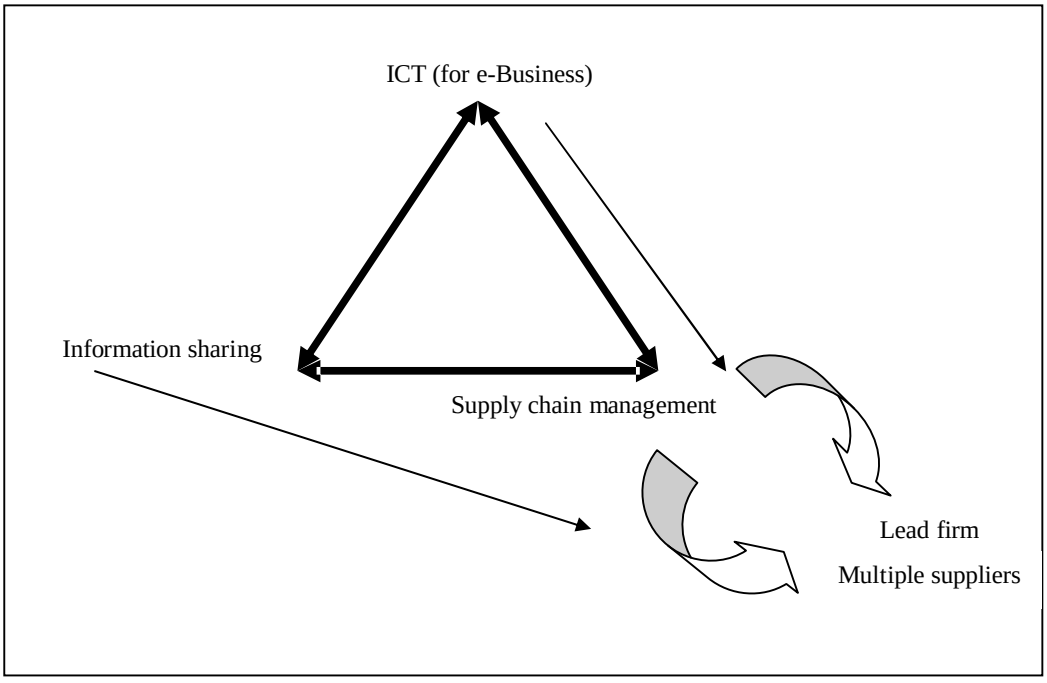
3.1 Introduction

The objective of this study is to analyse the impact of e-Business on SCM between a developed and a developing economy. This chapter will explain the structure of the data collection plan to achieve the research objective and answer the research questions. Essentially, this research attempts to capture information through a 'snapshot', in a fast developing environment. The literature review generated 12 research questions based on B2B supply chain (SC) communications (see Table 3.1). The questions are based on the relationships between supply chain management (SCM), information communication technology (ICT) and information sharing. Figure 3.1 illustrates the main variables being investigated. The unit of analysis is the upstream part of the SC, focusing on the manufacturing segment in the apparel sector in Sri Lanka. At the field research stage the research environment was manifesting signs of transformation from old to new methods of communications. Understanding the changes occurring to variables encompassing upstream supply chain activities and the dynamics of the buyer-supplier relationship (BSR) is crucial for gaining an insight into the impact of e-Business on SCM.

Table 3.1 Research questions

1. Why do some companies believe e-Business adds value to the organization? 2. What are the benefits of e-Business? 3. How important is information sharing in the apparel supply chain? 4. What are the negative aspects of information sharing, if any?
5. Why do some companies implement new ICT tools to facilitate e-Business? 6. Who influences the decision to migrate to a new ICT system? 7. Who controls the information sharing policy? 8. How can suppliers preserve competitiveness in a total information transparency supply chain? 9. What type of information sharing policy do they use?
10. How do current e-Business users position themselves in terms of usage? 11. What criteria can be used to evaluate an ICT tool? 12. Why do companies have high expectations of e-Business?

Figure 3.1 Research variables



3.2 Research plan

The research questions in Table 3.1 consist of 'how', 'why', what' and 'who' questions. The chosen methodological approach needs to penetrate the surface and reach for context rich data. A quantitative approach is unable to collect the level of details required to answer the research questions and is therefore incompatible with the research objective. According to Miles and Huberman (1994), quantitative studies usually do not provide rich insights about the research context. Qualitative methods, on the other hand, are designed for a comprehensive understanding, giving details and explanations (Sachan and Datta, 2005). In comparing the approaches, Miles and Huberman (1994) argue:

> *Qualitative data are a source of well-grounded, rich descriptions and explanations of processes in identifiable local contexts. The attractiveness of qualitative method is due to its ability to preserve chronological flow of data, identify which events lead to which consequences, and derive explanations that are not possible with quantitative methods* (Miles and Huberman, 1994: 1).

The level of knowledge on ICT methods in a developing country is varied (Silveira, 2003). In such a situation, technical questions may need explaining to derive an accurate response. This was the view of the representative of the Sri Lankan Export Development Board (EDB) who has extensive experience conducting research in this context. She strongly recommended a qualitative approach for this project.

Quantitative data is designed to identify 'how much' issues, for example, the percentage of apparel manufacturers using e-Business, and the number of suppliers sourced by using e-Business or traditional methods. Qualitative data, by contrast, can focus on exploring the reasons for new ICT usage in a greater depth by asking why companies are implementing new systems or how companies assess the effectiveness of e-Business. Sachan and Datta (2005) claim that there is a need for more qualitative approaches in SCM and logistics research because the existing studies are predominantly quantitative. They claim that further research should take a qualitative approach to investigate *behavioral issues by asking 'how' and 'why' questions* (Sachan and Datta, 2005:670). This study seeks answers to 'how' and 'why' questions in the form of qualitative data, using an interview based method. Specifically, the study used a

series of semi-structured and unstructured interviews to collect the data.

3.2.1 Exploratory, descriptive and explanatory studies

A research journey is determined by the goal that drives it. According to Yin (1994) the goal is decided by the how, what or who at the beginning of the research questions. The answers to the research questions will be dependent on the strategy formulation. The strategy required for exploratory, descriptive and explanatory studies is different as they pursue unique goals, but a single project may involve more than one strategy (Robson, 1993). In an exploratory study, the research focus is flexible and may change according to the insights gained from the research field. With this strategy the focus is initially broad but becomes progressively narrower as the research develops. The purpose of a descriptive study is to portray an accurate profile of persons, events or situations (Yin, 1994). This strategy requires a clear view of the phenomena on which one wishes to collect the data, prior to its collection. Often this strategy is criticised for its lack of evaluation and synthesis of ideas. However, this is a useful strategy for describing a situation and could be used as a forerunner to an explanatory research project (Saunders *et al*, 2000:97). Explanatory studies are designed to establish the relationship between variables. This type of study raises questions that deal with operational links that need to be traced over time rather than on mere frequencies or incidents (Sachan and Datta, 2005).

In this research an exploratory study was undertaken as a foundation stage (further explained in section 3.3). The insights gained were then analysed further by an explanatory study. This study also has some descriptive characteristics as it clarifies the situation regarding the lead firm, which was identified as an issue in the exploratory study. Yin (1994) differentiates the three strategies according to the type of questions they address. Table 3.2 illustrates some of the research strategies and their scope according to the particular situation.

Table 3.2 Relevant Situations for Different Research Strategies

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case study	How, why	No	Yes

Source: Adapted from Yin (1994:6)

If the research is designed to answer 'what' questions it is likely to be an exploratory study. For example, what is the impact of e-Business on supply chain management? The rationale for raising this type of question is to develop a pertinent hypothesis by generating further questions such as: How many participants use e-Business? What kind of benefits do they receive? By contrast, if the research is seeking to describe a situation by asking 'who' and 'where' questions, the study is likely to be descriptive. According to Yin (1994:6), *this strategy is used when the research goal is to describe the incidence or prevalence of a phenomenon or when it is to be predictive of certain outcomes.* For example, the question, who influences the decision to migrate to a new ICT system?, is based on the insights from the exploratory study[15]. This question could not be comprehensively researched without details of relationship dependencies, power and governance structures (Fawcett *et al*, 2006). To understand behavioural issues, such as dependencies and governance, 'how' and 'why' questions need to be posed. Yin (1994) explains that studies designed to answer 'how' and 'why' questions require in-depth investigation facilitated by an explanatory strategy. For example, why is mandatory information sharing enforced on suppliers?, how effective is e-Business compared to its predecessor? In conclusion, the research questions required an in-depth investigation to identify underlying assumptions. A combination of exploratory, descriptive and explanatory approaches was taken to answer the research questions. However, principally the study was an explanatory investigation.

[15] The exploratory study revealed that the lead firm applies pressure to implement new technology. The purpose of asking this question is to clarify the situation.

3.3 Research process

The methodological argument is better explained if the area of study is outlined first. In this study the aim is *to evaluate the use of e-Business in the upstream part of the SC, using the manufacturing segment in the apparel sector in Sri Lanka as the unit of research*. According to Miles and Huberman (1994), the quality of findings from an inquiry depends on the methodological decisions taken during the course of that research process. A clear explanation of the choices would eliminate any doubts regarding the suitability of a particular strategy used for data collection. In this section a detailed map of this research process is outlined, highlighting where the decisions were made (e.g. inductive or deductive decision) and why. Observing a holistic view, this section describes each stage of the research process from pre-research through to data analysis, for the purpose of explaining how the architecture for data collection was formulated and how the subsequent processes were implemented. See Appendix T for a diagrammatic illustration of the research process.

The research process in this study is divided into four sections, namely pre-research, foundation, empirical and data analysis. Under these four sections a further seven stages are designed to explain the process sequence.

The time period prior to 1st March 2002 is labelled as the pre-research section. Knowledge obtained from higher education specialising in operations management and commercial experience from apparel retailing (i.e. in 1996 and 2000) fuelled the decision to pursue this investigation. In November 2001 a visit to the state of New York in the USA provided the opportunity to discuss the popularity of the Internet in the B2C and B2B segments with academics at New York University (NYU). An interview with a NYU academic suggested that there is potential in the B2B area for combining supply chain management with new information communication technology (ICT) to conduct e-Business. The researcher has experience working with apparel manufacturers observing a downstream view. This presented many interesting questions to formulate a research proposal based on upstream processes for this study.

The foundation section consists of two stages, exploratory study and the literature review. The purpose of undertaking an exploratory study was to find a pertinent research focus in a potentially broad area. Interviews were undertaken with the

technology development division of a large apparel manufacturer. The findings uncovered several important topics. The topics include: order cycle times, paper free processes, buyer-supplier relations (role of the lead firm) and information sharing practices (e.g. the increase in the amount of information sharing due to new ICT methods). Out of these four topics, two were selected. The selected topics are labelled as themes for clarity. The two selected themes are as follows:

> *Buyer-supplier relationship (role of the lead firm)* - The strength of the Western retailer in the apparel supply chain is perhaps higher than in the automotive and food supply chains. The apparel industry (B2B) is a buyer's market and manufacturers in Eastern economies such as Sri Lanka, Malaysia and China are competing for orders in a global market[16]. This means that the buyer operating from a developed economy has considerable control over apparel manufacturers in developing economies and consequently can dictate the operations of the whole supply chain. In Sri Lanka, a handful of manufacturers dominate the production due to their mass production capability. Several of these companies have some type of collaboration with a foreign retailer or brand name either in terms of joint ownership or alliance.
>
> *Level of information sharing* – A majority of the respondents indicated that information sharing between buyer and seller is now more open. New ICT such as e-mail is more widely used than fax or telephone. Internet enabled VMI, ERP (SAP) and VPN were highly praised by all respondents. It appeared that a communication oriented working environment was emerging for supply chain management.

Themes were selected according to the respondents' perception of their importance. The respondents indicated that further understanding of SC relationships and the nature of information sharing in the SC would be useful.

The second part of the foundation section is the literature review. The literature review was divided into three sections: SCM, e-Business and information sharing. As mentioned previously, the literature review was focused on four themes, two of which

[16] At the time this market was governed by MFA trade rules.

were identified from the exploratory study and the others from the literature itself. The literature review identified several gaps regarding the themes.

The first part of the empirical section is the methodology design. It is the third stage in the overall research sequence. The purpose of this stage is to formulate the research plan to collect and analyse data according to the conceptual framework (see Section 2.13), in order to answer the research questions. The literature review was revisited to tune the research questions according to the research aim. This approach is depicted by a loop between the second and third stages.

The data collection stage completes the empirical section indicated as the fourth stage in the diagram. This study is based on thirty five interviews conducted in Sri Lanka and Hong Kong as the primary source of data. The interview questions were aimed at answering the research questions listed in Table 3.1. The participants consist of employees from five apparel companies, industry experts, process enablers (e.g. freight forwarders and fabric sourcing companies) and government officials. Subsequent sections (3.4.1 and 3.4.2) discuss this in more detail.

Data analysis is the fifth stage and data synthesis is the sixth stage in the overall process. Stages five and six use a framework incorporating themes, attributes and categories (TAC) to process data. This is discussed in the fourth chapter. Finally, stage seven presents the findings. Chapters five, six and seven provide analysis of findings.

3.3.1 Research philosophy and approach

Research can be undertaken according to two entirely different philosophies. It is either on the quantitative side (positivist paradigm or analytical school) or the qualitative side (interpretive paradigm or behavioral school) (Sachan and Datta, 2005). Mentzer and Kahn (1995) explain that in a positivist study reality is considered to be objective, tangible and fragmentable. They state that: *research findings in the positivist tradition are considered value-free, time-free and context independent, with the general agreement that casual relationships can be discovered* (Mentzer and Kahn, 1995:232). This type of study usually takes deductive reasoning to generate results.

In contrast to positivism, phenomenology interprets subjective meanings by qualitative

analysis. Saunders *et al* (2000) argue that a phenomenological or interpretivist approach is used to examine *the details of the situation to understand the reality or a reality working behind them* (Remenyi *et al*, 1998:35 in Saunders *et al*, 2000). This approach adopts inductive reasoning as results are generated through the researcher's interpretation. In this project, the researcher interprets qualitative data according to his perceptions and therefore it is closer to a phenomenologist philosophy. The available methodological options are listed in Table 3.3.

Table 3.3 The research process Options

Research process step	Research philosophy	Research approach	Research strategy	Time horizon	Data collection methods
Options	Positivism Phenomenology	Deductive Inductive	Experiment Survey Case study Grounded theory Ethnography Action research	Longitudinal Cross-sectional	Sampling Secondary data Observations Interviews Questionnaires

Source: Adapted from Saunders *et al* (2000)

A review of 442 articles from 1999-2003 in the journals of Business Logistics, International Journal of Physical Distribution and Logistics Management and Supply Chain Management: an International Journal by Sachan and Datta (2005) revealed that positivist studies are predominant in logistics research and that the survey method was used in more than half the articles. They conclude that interview and case study methods should be used in future research to identify behavioral issues and how they are influenced by factors such as culture, relationship, trust and power. In light of the power of the lead firm in the apparel SC (See section 3.3) it appears appropriate to use an interview or case study method in this research.

3.3.1.1 Grounded theory

This method is used as a theory building approach that combines both induction and deduction (Glaser and Strauss, 1967). Data collection starts without the foundation of a theoretical framework. Based on a series of observations, theory is formulated. These data are used to generate hypotheses, which are then tested in further observations (Saunders *et al*, 2002). According to Eisenhardt (1989) grounded theory operates inductively in case research to answer the research questions. This has some similarities to this study. Data analysis used in this research project is iterative and has a tight link

to data and pursues new insights as in a grounded theory approach. However some prominent features of grounded theory, such as problem definition and construct validation for hypothesis testing are not relevant because it is not used in this research. Table 3.4 compare method used in this study with grounded theory.

Table 3.4 Comparison of adopted approach for data analysis with grounded theory

Stage	This research approach	Grounded theory
Format for data collection	Theoretical framework	Observations and hypothesis generation
Data analysis	Structured analytical framework (inductive and deductive)	Unstructured (inductive and deductive)
Purpose	Answer research questions	Hypothesis testing or answer research questions
Research process flexibility	Low-medium	High

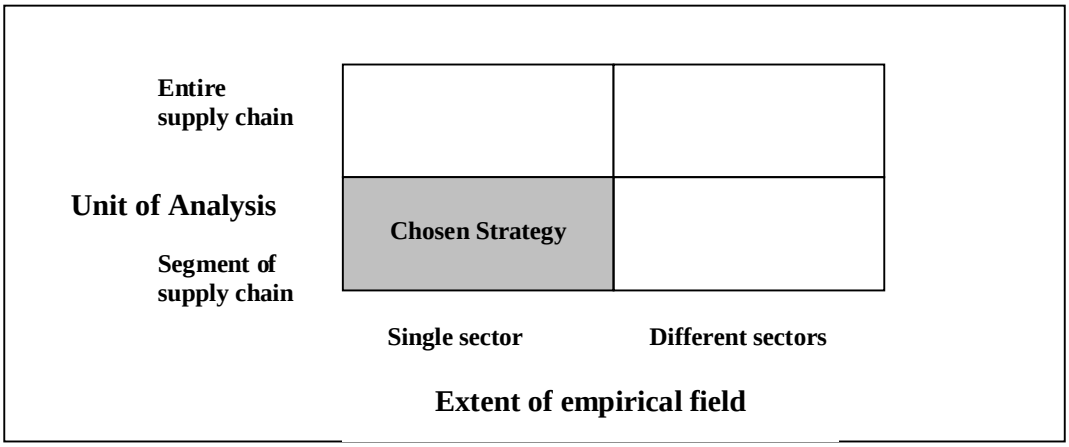
The main difference between the method used in this research and grounded theory is that this study adopts a structured approach for data collection and analysis. There are some similarities in that both approaches allow insights to emerge from the data and subsequently follow those insights. Principally this research study collected data based on a theoretical framework informed by the literature review (i.e. four themes). The analytical framework used for data analysis was also based on the literature. This means that both approaches use a mix of induction and deduction and a flexible data collection process. However, the degree to which this research is structured differentiates the two approaches.

3.3.2 Research strategy

There are several ways of conducting research. The goal is to identify what type of data is required and chose an appropriate strategy considering the available resources. The choice of the research strategy in this study is based on the discussion of Spedale (2000) together with other studies related to this area. Spedale (2000) outlined co-operation, relationships and performance in the network supply chain.

Before discussing some of the available strategies, it is essential to outline the unit of analysis and the extent of the empirical field covered for data collection. Figure 3.2 presents four alternative research strategies in the spectrum of unit of analysis vs. extent of empirical field covered.

Figure 3.2 Research Strategy Matrix: a Comparison of alternatives



Adapted from Spedale (2000:80)

The research strategy matrix provides four quadrants of inquiry: entire SC in a single sector, a segment of the SC in a single sector, the entire SC in different sectors, and a segment of the SC in different sectors. The available literature suggests that with the exception of Min and Galle (1999) other research does not use the same research quadrant as in this study (i.e. segment of SC in single sector, see Table 3.4). Employing a mail survey method Min and Galle (1999) focus on 'how much' and 'what' questions. In particular, they identify the volume of transactions involved in B2B e-Purchasing and what issues are driving supplier numbers. However, as a consequence of using a mail survey method, Min and Galle (1999) fail to answer intangible questions such as how a relationship is developed with the use of e-Business, or why particular buyer-supplier relationships are stronger than others, or how such relationships can influence a company to implement ICT tools for e-Business. Furthermore, Min and Galle's (1999) research does not provide specific insights about the apparel industry. Table 3.4 illustrates the methodological approach adopted in other research in supply chain management with Internet technologies.

Table 3.5 Research in other quadrants

Entire SC in single sector	Segment of SC in single sector	Entire SC in different sectors	Segment of SC in different sectors	Empirically tested Y/N	Method
Moedas (2006)				Yes	Interviews
	This study	Croom (2005)		Yes	Multiple case studies
		Silveira (2003)		Yes	Multiple case studies
			Nikolaeva (2006)	No	Secondary data
	Min and Galle (1999)	Power (2005a)		Yes	Survey
Christopher *et al* (2004)				No	Conceptual
Pires *et al* (2001)				Yes	Single case study
		Sahin and Robinson (2002)		Yes	Survey
		Lancioni *et al* (2000)		Yes	Survey
		Frohlich and Westbrook (2001)		Yes	Survey

Source: Literature review

Most previous studies employ a survey strategy to test their hypotheses (Sachan and Datta, 2005 and Mentzer and Kahn, 1995). One reason for this could be the unexplored potential in this phenomenon (Croom, 2005). Academics are keen to cover a large area before undertaking in-depth inquires. However, there are some instances where a case study method or an interview-based method has been used. Authors such as Van Der Vorst *et al* (2002) and Pires *et al* (2001) argue that in depth interviewing is the best method for this type of inquiry. The present study agrees with this statement and uses an interview-based method to answer questions on a cross-company comparison (see Section 3.3.2.3). Authors such as Moedas (2006), Croom (2005), Silveira (2003), Van Hoek (2001) and Van Hoek and Chong (2001) use a qualitative approach but unfortunately this does not provide an adequate explanation of the area under

investigation. For example, Van Hoek (2001) and Van Hoek and Chong (2001) use only one company for their research and, as a consequence, cross-company comparison is not possible. Silveira (2003) conducts a cross-sectional study with five companies in Argentina. His research does not include the apparel sector. Croom (2005) undertakes a cross sectional, multi sector exploratory study of the phenomenon (i.e. impact of e-Business on SCM). He includes the apparel industry in the investigation but his research is unable to provide in-depth details as it was an exploratory study. Moedas (2006) used the interview method to conduct an exploratory study of the apparel industry. Her research provides broad views regarding integration between upstream product design and downstream retail stores but fails to capture in-depth details.

3.3.2.1 Unit of analysis

The two available options for the unit of analysis are: the entire supply-chain or a segment of supply chain. The adoption of the entire supply chain as the unit of analysis would mean that the e-Business impact at each stage of the supply chain would be identified. This option is particularly attractive for various reasons. Perhaps the most important would be originality. Research covering the entire supply chain is rare. The major implications of this option are time constraints, access, participation, and the reliability of data. Outlining the difficulties of researching the entire supply chain Beach *et al* (1998a) argue:

> *Gathering data on the performance of a single channel member is often difficult enough. Gathering data for the multiple channel members (raw materials suppliers through retailers) that operate as a single supply chain is prohibitively difficult due to limited access to the data and poor quality in that data when it is accessible (*Beach *et al,* 1998a: 23).

For this study, the unit of analysis is the upstream part of the supply chain (i.e. manufacturing stage in Sri Lanka). The impact of ICT is evaluated from the manufacturer's viewpoint. This selection was made according to accessibility to data. Further discussions on selecting this segment are provided in section 3.4.1.

3.3.2.2 Extent of empirical field

The extent of the empirical field covered has the options of comparing units within the same sector or to extend the study to units across sectors (Croom, 2005). If the latter is undertaken, the findings would be comprehensive with greater opportunities for generalisability (Moedas, 2006). However, it is always important to confirm the scale and scope of a study. Research involving cross industry comparisons would require a long period for data collection and knowledge of various industries to explain the results. Resource constraints force a trade-off between the depth of data capture against breadth of field coverage.

In this study, the extent of the empirical field is limited to a single sector. This provides a narrower focus to conduct an in-depth inquiry confined to the apparel sector. As a result, this study was able to penetrate to deeper levels to identify behavioural issues. There are other practical and theoretical advantages gained from limiting the study to a single industry. From a practical point of view, there is less concern about the resources (i.e. time and finance). At a theoretical level, comparison between two units is easier due to similarities in the external environment.

3.3.2.3 Strategy selection

As mentioned before, most of the research in supply chain management uses surveys to derive broad views on practices and processes. The use of surveys is desirable due to such reasons as opportunity for generalisability, shorter time period, relatively less effort, less intrusive on participants, cost, managing an orderly set of data, and the wider coverage of issues. However, the survey strategy is unable to uncover how a particular phenomenon reacts under certain situations or why it is occurring in the first place. According to Yin (1994):

> *Case studies/interviews are the preferred strategy when 'how' and 'why' questions are being posed, when the investigator has little control over events and when the focus is on a contemporary phenomenon within some real-life context* (Yin, 1994:13).

The Operations and Production Management Society (POMS) encourages researchers to

use in-depth qualitative studies as understanding intangible relationships is becoming increasingly more important in this field. They claim that most academics acknowledge the value of interview based research in this area. The POMS identifies three vital reasons why such an approach is important:

1). In depth qualitative studies are an effective way to generate hypotheses that may then be further validated using empirical data or analytical models.

2). For many topics, it is difficult to generate multiple data points. It is hard to study the Toyota Production System, for example, using a large data set, since very few companies have successfully adopted the system. An in-depth study of one company is appropriate under such circumstances.

3). At times, qualitative studies have shorter lead times and, hence, can derive insights while more rigorous studies based on extensive empirical data and analytical models are being completed. For example, case studies can be used to study the impact of the Internet on supply chains, a topic, in POMS' opinion, which is not currently understood well enough for analytical models.
(http://www.poms.org/POMSWebsite/Journal/dept-mission.html 30/03/05)

The research design prior to data collection intended to compare two sets of companies. A comparison was proposed between companies that use e-Business and companies that do not use e-Business. However, initial discussions with industry contacts and the EDB revealed that the situation regarding e-Business usage is more complex than that. There was no clear division between users and non users. More realistically, Sri Lankan apparel manufacturers appear to be at different levels of e-Business usage. The e-Business capability at the manufacturers appears to be at three levels:

Higher end (advanced) – Medium to high level of e-Business aspiring to SC integration.

Middle (less advanced) – Infrastructure in place for e-Business. Starting to use e-Business applications such as VMI over the internet.

Lower end (least advanced) – Infrastructure building in the pipeline to enable e-Business. Predominant use of traditional technology such as fax with some use of

internet access for e-mail but not practising e-Business.

Initial discussions revealed that very few Sri Lankan apparel manufactures would have advanced e-Business capability and that the majority of them would have less advanced capability. An inquiry into e-Business levels was a better prospect than initially planned. At that stage, the research design was amended to accommodate the situation. By using companies with different e-Business levels a better understanding of ICT impact according to capability and usage levels was now possible. For example, why do manufacturers have different e-Business capabilities?, what are the circumstances? And how accurate is the description of e-Business levels? During the field research period, some companies were testing their new system; others were implementing e-Business or planning to implement a new system. As a result of conducting this research at a time of transformation, the participants answered the interview questions with fresh memory, enthusiasm, and authentic examples. The transformation process was researched in detail and recorded live.

In total, this study investigates five companies to answer the research questions. These companies were chosen to reflect different levels of e-Business capability and usage. Background knowledge, information from industry contacts and advice from the EDB were used to select the five companies. More details on the participants are discussed in section 3.4.1. By using five companies, a wider spectrum of e-Business levels from inception to maturity was covered. By comparing companies of a similar scale (i.e. companies with at least 500 employees), this study avoids a potential source of 'noise' from research findings created by company size variations.

3.3.3 Time horizons

The choice between longitudinal or cross-sectional study depends on the type of research questions. Is the research observed as a 'snapshot' taken at a particular time or is it in the form of a 'diary' of observations of an event over a given period of time? A cross-sectional method involves *the study of a particular phenomenon (or phenomena) at a particular time* (Gill and Johnson, 1991: 70). A longitudinal study can be defined as *a research project that observes the variables of the same person, group or event over a given period* (Dixon *et al,* 1987:112 in Sain, 2004). A longitudinal method is not compatible with the research goals, as it requires a lengthy time period, which is not

available and furthermore, this research is based on comparison at a particular time.

The research design adopted is a cross-sectional study as we aim to determine the current situation regarding ICT usage. However, some historical data may be required for comparison purposes between pre-e-Business and e-Business practice. For example, how suitable is e-Business to achieve the intended purpose compared to previous ICT technology? In order to answer this question the respondent must refer to past practice. In that case the research is not just a 'snapshot' of the current issue but rather a 'snapshot' with a historical description. Due to the fast changing nature of ICT, historical knowledge may be required to answer any type of comparison question. This suggests that this type of study can be described as a cross sectional study with a historical background.

3.3.4 Data quality criteria

The chosen data collection method should preserve the validity (integrity) of the research design, reliability and generalisability (reproducibility) of the research findings (Remenyi and Williams, 1995). Table 3.5 contains key questions concerning validity, reliability and generalisability according to the two research philosophies. This project may achieve limited generalisability as the research sample is restricted to five companies. Furthermore, explanatory studies by nature provide depth rather than breadth, limiting generalisability (Yin, 1994). However, it could be argued that supply chains are complex and are driven by unique sets of circumstances. For example, the dynamics of a particular supply chain depend on the industry, number of suppliers, the lead firm (i.e. retailer, manufacturer or assembler) and geographical distance. Therefore, broad generalisations are not a major concern.

Table 3.6 Questions of reliability, validity and generalisability

Criteria	Phenomenological viewpoint	Positivist viewpoint
Validity	Has the researcher gained full access to the knowledge and meaning of informants?	Does an instrument measure what it is supposed to measure?
Reliability	Will similar observations be made by different researchers on different occasions?	Will the measure yield the same results on different occasions (assuming no real change in what is to be measured)?
Generalisability	How likely is that ideas and theories generated in one setting will also apply in other settings?	What is the probability that patterns observed in a sample will also be present in the wider population from which the sample is drawn?

Source: Adapted from Easterby-Smith *et al* (1991)

Remenyi and Williams (1995) argue that research on the behaviour of a phenomenon requires depth rather than breadth, trading off generalisability for a comprehensive understanding. They argue: *In many research studies generalisability in not an issue, rather the concern is to understand a particular, usually successful operational capability* (Remenyi and Williams, 1995:195).

3.4 Data access and data collection method

3.4.1 Choosing participants (companies)

This study uses interviews to investigate e-Business use in SCM. Five companies were deemed sufficient to represent different levels of e-Business (e.g. adaptation and use), based on the insights from background interviews at the beginning of field research.

A major concern at the design stage was company participation and access to relevant data. Companies are reluctant to become involved in studies that incur large amounts of employee time and present a potential danger through exposing their competitive advantages (Croom, 2005). To overcome this problem, the Export Development Board (EDB) of Sri Lanka was approached. From the EDB, a directory of apparel manufacturers was obtained, which provided valuable background information and contact details of every important person in all apparel exporters in Sri Lanka. The involvement of the EDB brought credibility to this study and all participants viewed this positively. The EDB also provided advice in the form of 'expert' opinion regarding apparel industry practices and methodology.

To add structure to the study and provide a comparable platform to conduct analysis in subsequent stages (Yin, 1994), a sampling design containing the following criteria was adopted:

- Level of e-Business use – from non usage to currently practising (if currently not practising e-Business, having the capability to implement e-Business)

- History of exporting to the UK, at least 3 years of continuous trading,

- Inclusion of companies with at least 500 employees

- Clearly defined organisational structure.

As previously discussed, it was initially intended to compare two groups of e-Business users and non users. According to insights from the background interviews at the beginning of the field research, the sampling design was amended to include different levels of e-Business rather than two definitive groups. In other words, the sample for this investigation represents e-Business levels. This change presented a better opportunity to understand the phenomenon as it followed the transformation route. Section 3.3.2.3 previously explained the e-Business levels.

The history of exporting to the UK is important for several reasons. The communication between the buyer and the manufacturer is usually directly proportionate to the amount of trade (Zhao *et al*, 2002). The relationship dynamics are likely to be influenced by the length of collaboration and the successes and failures of past experiences (Power, 2005b). For example, in a dependent-provider situation the dependent company could perceive certain questions as intrusive or potentially damaging to their relations with the buyer (Svensson, 2002b). Because of this they may provide varnished answers to protect the provider. By establishing the export history, the answers were reviewed with an appropriate level of caution and the data analysis was better informed.

Company size is used as a filter to select companies with varying resource capabilities. The number of employees acts as a reliable indication of a participant company's size. Large companies are attractive for several reasons. They are more likely to have the financial capabilities to implement a new ICT system. Larger manufactures tend to be direct suppliers rather than sub-contractors. They have first-hand knowledge of the UK-Sri Lanka supply chain. Their volumes of transactions are significantly greater, warranting a greater need for sophisticated ICT such as e-Business. The knowledge required to answer questions is also potentially greater due to their exposure through international trade and technical knowledge transfer from the UK buyer.

Findings from unstructured organisations are perhaps more difficult to interpret as job roles and departments overlap. Participant companies with a clear structure facilitate systematic interview scheduling. The validity of the data can be triangulated with upper

or lower designations. It provides a more accurate platform for comparison through cross company referencing (Miles and Huberman, 1994).

3.4.2 Choosing respondents (interviewees)

Three types of respondents are involved with this study. They may be categorised as background, core and expert. Background interviews provided information to conduct core interviews. Core interviews were aimed at collecting data to answer the research questions. Expert interviews provided depth to the investigation by following the insights gained from the core interviews. A facilitator was employed to organise background and core interviews. For further details about the involvement of the facilitator, see Appendix U. The main sources of data are core and expert respondents. The two sampling methods discussed in this section only refer to core and expert respondents. Due to the limited number of background respondents a specific sampling method was not warranted. However, it is useful to note that background respondents were selected according to opportunity, respondent's knowledge of the situation and researcher's contacts. This study consists of comparable and sequential sampling (Miles and Huberman, 1994:27 and 28).

Core respondents were sampled through comparable sampling. They were sampled according to the participant's organisational structure. The main intention of using this method was to increase the robustness of the analytical findings on the grounds of comparability. For example, comparing the views of the ICT manager at Company A to the views of the ICT manager at Company B would be more appropriate due to the same level of designation. Certain respondents in the organization were conveniently avoided according to insights from the facilitator and initial screening process. The screening process was undertaken through telephone conversations with the potential respondent when arranging the interview. The main reason for exclusion was lack of knowledge on their part of the phenomenon under investigation. As a result, time was saved to concentrate on respondents with a higher level of knowledge. On average four respondents from each company were selected for core interviews from the areas of export, purchasing, operations, IT, marketing and general administration. The reason for this selection was their work related knowledge. Identifying the most suitable respondent was critical for the purpose of collecting the most relevant information. Operations and IT departments were targeted as it was likely that they would have

knowledge of supply chain activities and ICT usage. Other functions such as purchasing, production or general administration were equally important to gain a detailed view of the participant's involvement with the phenomenon in its entirety. The core respondents had to fulfil the following requirements:

- A senior manager with decision-making power who regularly contributes to strategy formulation in the relevant departments.
- Possesses a thorough knowledge and experience of supply chain activities.
- Possesses an appropriate level of knowledge on different ICT methods such as VMI and EDI.
- Consents to participate in the research, allocating approximately one hour for each interview.
- Provides references to support answers and facilitates access to subordinates if further details on processes are required.

These requirements were applied during initial information gathering, discussions with the facilitator and in arranging interviews. A total of 23 core respondents were interviewed from five companies. Appendix V presents a table with details of the core respondents.

Sequential sampling was used for sampling expert respondents. These respondents were sourced according to their expertise in the emerging trends that needed further clarification. According to Miles and Huberman (1994), *samples in qualitative studies are usually not wholly pre-specified, but can evolve once field work begins* (Miles and Huberman, 1994:27). A total of 12 expert respondents were interviewed from Sri Lanka and Hong Kong. The expert respondents had to fulfill the following requirements:

- Be at director level in the corporation or enterprise.

- Possess extensive knowledge in the relevant field in relation to the phenomenon under investigation.

- Agree to provide impartial views.

- Consent to participate in this research allocating between one and two hours to the researcher.

The expert respondents include: deputy director at EDB (Export Development Board) in Sri Lanka, telecom head of IP (Internet Protocol) and broadband at Sri Lanka Telecom (SLT), private enterprises such as EDL (e-Development Laboratory), director at a freight forwarder, superintendent head of IT at Sri Lanka Customs, senior economic consultant at Ministry of Policy Development and Implementation and Ministry of Economic Reform, Science and Technology and deputy director at e-Business Research Institute at Hong Kong University. Appendix W provides a table with the details of expert respondents.

3.5 Accessing data

The research design provided vital guidance to undertake data collection. However, there were unavoidable macro events such as political instability in Sri Lanka which delayed the investigation. This presented problems for accessing the required data. As a contingency, the time allocated for data collection was extended. However, the additional time allowed the number of interviews to be increased.

3.5.1 Initial information gathering

At the time of recruiting participants global brands such as Nike were under heavy criticism for using child labour in their production plants. Large apparel manufacturers were under pressure from international humanitarian organisations like UNICEF (United Nations Children's Fund) to improve their working practices. As a consequence of these events the success rate of recruiting participants was lower than excepted. Senior managers were suspicious about an in-depth investigation into their working practices. The solution was to establish trust and clearly communicate the intentions of

this inquiry. This was achieved by posting a letter before departing from the UK to several potential participants explaining the nature of the inquiry and assuring confidentiality and anonymity (See Appendix X). By posting from the UK with the researcher's institute seal the expectation was to add credibility to the investigation, hopefully improving the willingness to collaborate. The benefits to the participants were explained to avoid the researcher being perceived as intrusive, arrogant or ignorant of the company's specific situation. Where requested by the participant, a letter from the researcher's supervisor was also sent.

3.5.2 Conduct of interviews

3.5.2.1 Types of interviews; purpose, outcome, critique

There are three categories of interviews: background interviews, core interviews and expert interviews. The interviews were arranged with the help of agents. In total there were three such agents. The agents' main task was to open doors to 'closed companies' and pass gatekeepers. These agents set up meetings with companies that are usually perceived as 'closed'. It appeared that a highly turbulent environment fuelled the anxiety felt by these companies and recruiting potential participants proved difficult without the help of these agents. The agents provided useful contact details and personal recommendations about the researcher to relevant parties. The agents aided setting up meetings with busy CEOs and top management who would not concede their precious time without an internal recommendation.

The 'background' interviews aimed at gaining an understanding of the nature of the apparel industry, company culture, and interesting issues prevailing in the company. Several of these background interviews were conducted with Agent 'A'. They also identified useful personnel within the company and provided an idea about the respondent's character. The 'background' interviews played an important role in improving the interview style. At times it was necessary to keep the participant interested in order to get more interviews from the same company. Background interviews provided a rich source of issues prevailing in the company. For example, it was proving difficult to convince Company A to participate in the research. After some negotiations, facilitated by Agent 'C', the IT manager at Company A agreed to a half-hour interview. In preparation for this meeting the researcher had two background

meetings with Agent 'A' in order to identify interesting company issues. One such issue identified was that Company A is trying to adopt a 'concept to marketing' (CTM) policy. This programme is designed to reduce lead-time by over half. Ways of achieving this difficult task were still being brainstormed by the top management. The first 10 minutes of the interview with the IT manager were spent on discussing possible ways of reducing cycle time in order to reduce the overall lead-times. As a result of this the interview lasted over an hour and at the end of the interview the respondent agreed to facilitate three more interviews at Company A. Another advantage of background interviews was the ability to change the style of the interview according to the participant's character. For example, the commercial manager at Company E is a very senior figure who commands respect and authority. It was important to give him space and to interrupt as little as possible. As a result of the interview style, the participant was comfortable, relaxed and provided answers at ease. In another instance, the researcher had information which suggested that the commercial manager at Company A regularly provides evidence on his comments. In this case, more points were covered, as documentary evidence was available for more details.

Core interviews are the main source of data collection for this study. The purpose was to obtain in-depth qualitative data. In total, twenty three core interviews were conducted at five apparel manufacturers in Sri Lanka. Fifteen of these interviews were conducted with respondents in top management positions. Duration of a core interview lasted between 40 minutes to 2 hours depending on circumstances. Factory tours were made either before or after core interviews at each of the five companies. This provided visual insights into the practices discussed in the interview. It also gave an idea about the scale of operations at each of the factories.

The reasons for conducting expert interviews were discussed in Section 3.4.2. These interviews improved the investigation by clarifying insights gained during the core interviews. The expert interviews were conducted with high profile individuals. As a result, recruiting of further respondents was strengthened. Appendix Y summarises core interviews and expert interviews in the sequence they were conducted.

3.5.2.2 Interview structure

The focus of the interview questions encompassed three main areas: ICT (to facilitate e-

Business), information sharing, and supply chain management. The structure of the interviews varied according to interview type, respondent's knowledge of the phenomenon and time allocation. When arranging the interviews, a list of topics was given for the respondent to prepare in advance. This approach saved time and attention was given to important issues. The list of topics was accompanied by a brief description of the study and the researcher's aims for the interview. Some participants were not used to research interviews and understandably appeared nervous about the confidentiality of data. The researcher assured confidentiality and anonymity, mostly for respondents in government institutions. The researcher felt that a good interview had taken place when the respondent answered questions openly and felt comfortable giving answers. In order to facilitate this, most interviews started with an 'ice breaker', such as, I heard you studied at LSE, so what have you done at work today? What is it that you do around here? You seem to be busy; At what time do you normally leave work? The 'ice breakers' appear to have relaxed the interviewees in many cases.

Prompts were used to keep the discussion flowing. On average there were between 8 to 12 prompts depending on the time allocation. The main purpose of the prompts was to act as a checklist. Some standard questions were used in most 'core' interviews. For example, how long have you had e-Business? Why do you think e-Business is important? What type of ICT do you use at present? How would you describe your SC? What has been the impact of the Internet so far on your job? The interview questions were changed according to the situation and the experience of the respondents. For example, in one instance the participant had used e-mails from their inception. Under those circumstances it was pointless to ask the respondent: how did you recognise the need for e-mail? Rather, it was more constructive to ask: what are the problems you encounter with the current system? In an earlier instance the respondent was unclear about the definition of e-Business. When asked the question: how long have you had e-Business?, the answer was: *I don't think we are doing e-Business yet but we are doing vendor managed inventory (VMI) over the Internet, real time production system (RTPS), e-mail, and web conferencing*. The functions described by the respondent were all e-Business activities and his perception of e-Business was very restricted. The subsequent correspondence for setting up interviews consequently included a definition of e-Business according to this research. This included the definition of e-Business constructed by this study (see Appendix M) and an explanation of the type of ICT tools involved with e-Business.

The standard of the questions was raised for chief executive officers, managing directors, general managers, and senior consultants as they are considered to be visionaries in the field. For example, what do you think is the intended purpose of e-Business? Has e-Business achieved its intended purpose? Is e-Business nice to have or need to have? How practical is SC integration? Some respondents' knowledge was practice based and they had limited knowledge about the latest academic theories. For example, the questions on information sharing (in a totally integrated SC) were not clearly understood by two of the respondents. This was evident by the look on their faces and some interviewees responding: *You have a good question there*. In those instances, a brief explanation was made for his/her benefit. An explanation was provided with the condition that the allocated time would be increased and the time allocated for the research questions would not be compromised. The explanations were made according to established theories and an appropriate level of care was taken to ensure that the explanation would not influence the respondent's response.

The researcher feels that his interview technique improved with experience. Several lessons were learnt from the first interview. Among them, a main point was to cover few issues in depth rather than more in breadth. At first the researcher concentrated on covering a list of topics as compared to developing a discussion. This creates a problem in obtaining in-depth information. Following this insight, changes were made to the interview structure. As the research developed, the confidence and the approach improved with lessons learnt from the previous interviews. One such valuable lesson was to let the interviewee talk uninterruptedly when relevant information was being divulged. Important questions were asked early as the participant might have to leave on an urgent matter. By asking questions with reference to the current company situation the researcher was able to keep the participant interested and extend the allocated time.

3.5.2.3 Language

There are three official languages in Sri Lanka. Most widely used are Singhalese followed by Tamil and English. Since the time of the British Empire, Sri Lankans have been using English as the commercial language. The researcher is fluent in Singhela, which is his mother tongue, and English. This presented a unique advantage to switch languages during interviews as required. Where the respondents were not very fluent in

English, Singlish was adopted, which is a combination of Singhalese and English. Singhela was used by some respondents when certain catchphrases or folk stories were cited as examples. Top executives preferred to converse in English because certain western terms are better communicated in this language. Almost 90 percent of respondents were fluent in English and therefore most interviews were conducted in English. The necessary translations were carried out at the transcribing stage to convert the interviews in Singlish to English.

3.5.2.3 Record keeping

It is advantageous to tape-record interviews as it is more effective compared to recalling from memory (Miles and Huberman, 1994). Information recalled from memory could be distorted with subsequent pieces of information. It could present gaps in certain conversations and often omit small details important at the data analysis stage. More importantly it could inject bias in to the research. All the interviews were tape recorded with the permission of the respondents. Most of the core interviews were conducted in conference rooms at the participant's premises. This presented a quiet environment to conduct recording. In some instances, the researcher asked for the background music or air conditioner to be switched off to improve the recording. There are many advantages of tape-recording interviews such as:

- Less pressure on the researcher to take notes during the interview
- Maintain eye contact to encourage the information flow
- Observe body language according to responses
- Improve accuracy of data for subsequent analysis
- Concentrate on the interview rather than divert attention to recording.

Nevertheless, notes were taken as a back-up of important information, to record body language and formulate emerging or additional questions.

Some respondents in government institutions were uneasy about tape recording. Their

main objection was due to third party access to the tape. These respondents agreed to be tape recorded after assurance of confidentiality by the researcher.

3.6 Data transcription, management and analysis

3.6.1 Data transcription

The thirty five interviews undertaken in Sri Lanka and Hong Kong were tape recoded for the purposes outlined in section 3.5.2.3. In total, more than 40 hours of interviews were recorded. Despite the time pressure, 80 percent of the interviews were transcribed verbatim. Other interviews were kept in audio format for reference. The interviews selected for transcription were those considered more important to the research.

3.6.2 Data management

According to Miles and Huberman (1994) data management consists of data collection, storage and retrieval. In this study, the data collection process followed the conceptual framework formulated at the literature review stage. A detailed description of data collection was undertaken in sections 3.5.2.1 and 3.5.2.2. The data was assigned to sections of the conceptual framework to identify which attributes (in the framework) needed further data. Subsequently, data collection continued until the requirement was satisfied. The collected data in terms of recorded tapes, observation notes, post interview comments and reflections written-up by the researcher, and the researcher's diary were stored in a safe place. It was necessary to have regular access to untranscribed tapes for data retrieval purposes. Data management was undertaken by compiling data files for each of the participant companies. Chapter five provides further details about the data files.

3.6.3 Data analysis

The thirty-five interviews undertaken in Sri Lanka and Hong Kong are the main source of data used in analysis. As discussed previously, interviews are classified according to interview type. (See Appendix Y expert interviews are double lined). The main source of information is found in the core interviews; other sources of data mostly contribute to

triangulation of data and to identify subsequent links. Data collected from other methods such as observation notes, post interview comments and reflections written up by the researcher and the researcher's diary complement individual interview transcripts. Additionally highlight pens and A3 paper were used to mark important comments.

Data analysis for this research was a continuous activity, which was undertaken during the data collection and immediately after to obtain a filtered set of data (Miles and Huberman, 1994). This research adopts a themed approach to analyse data. According to Bruce *et al* (2004) a thematic approach provides structure and clarity to discussion. The idea behind initial filtering was to streamline the data collection process by reinforcing existing themes, identifying new themes, or discontinuation of others. As explained in Appendix U, interaction with the facilitator provided the opportunity to contextualise certain issues (e.g. company culture, apparel industry practices, sensitive information) in parallel to data collection.

In this study data analysis is undertaken using the Themes, Attributes and Categories (TAC) framework. According to Saunders *et al* (2000), by adopting a structured approach, (e.g. using a theoretical framework), the data will link into the existing body of knowledge and also provide an initial analytical framework. It provides a systematic and logical approach for collecting and analysing the data (Miles and Huberman, 1994). It moreover links the whole research project from the initial exploratory study to the present stage of the research. The data matrix was the primary tool used for data analysis. It allocates data according to attributes. For the template of the data matrix see Appendix Z. The TAC framework emerged from the data analysis. It represents themes, attributes and categories. The four themes used for the literature review and in the conceptual framework were continued to analyse the data. Attributes were identified during the literature review. A theme is characterised by several attributes. At the beginning of the analytical process, the data analysis framework contained two columns: themes and attributes, which created the TA framework. The composition of the attribute column changed according to insights from the field data. The category section was added to reflect the changes to the attributes. Adding of the category section created the TAC framework. Section 4.2.3.3 explains the transformation of the framework in more detail. According to Saunders *et al* (2000) predetermined theoretical frameworks may need adjustment to reflect interviewees' responses.

Finding answers to a research question involved two or more attributes belonging to two or more categories. For example, to answer the question, what are the benefits of e-Business?, the attributes quantity of information and accessibility of information belonging to the category PC and the attributes operational and strategic belonging to the category LF had to be analysed. In other words, a combination of categories (i.e. PC-LF) is required to answer this question. Similarly, during the process of answering the twelve research questions three category combinations emerged from the TAC framework. This means that the category combinations represent answers to the research questions.

3.7 Summary

This study evaluates the use of e-Business in the upstream part of the SC, using the manufacturing segment in the apparel sector in Sri Lanka as the unit of research. The research process involved several stages starting from pre-research to data analysis (See Appendix T). The literature review provided models, frameworks and research questions for this investigation, which focuses on ICT, information sharing and supply chain management. A review of 442 articles published between 1993 and 2003 (Sachan and Datta, 2005) revealed that future research should adopt qualitative methods to identify behavioural issues in logistics and SCM. Moreover, the type of data required for answering the research questions is in-depth qualitative data. Consequently, interviews were selected as the most appropriate method for data collection. The investigation acted inductively insofar as it pursued interesting insights emerging during fieldwork and deductively in testing data from the exploratory study and information from the literature review. With regards to time horizon this study is essentially a 'snapshot' of the research issue, supported by historical data.

Five Sri Lankan apparel manufacturers comprised the research sample. This sample was selected because of appropriateness, accessibility and expert recommendation, and the level of resources available to the researcher. Thirty-six interviews were conducted in Sri Lanka and Hong Kong with three types of respondents. The interview types were: background, core and expert. The background interviews facilitated the research process by identifying prevailing issues and the key interests of companies. The core interviews are the main source of data, while expert interviews were used to validate data. Finally,

the TAC framework was introduced as an analytical framework. The next chapter provides further discussion on data analysis.

CHAPTER FOUR DATA ANALYSIS FRAMEWORK

4.1 Introduction

The next chapters of the thesis are dedicated to the empirical findings of the research. The purpose of this chapter is to explain the data analysis methodology. Subsequently in Chapters 5, 6 and 7 the findings are presented and discussed. These three chapters provide the findings according to category combinations derived from the conceptual research model. The three findings chapters follow the category combinations. The methodology chapter introduced how the category combinations emerged from the TAC framework. Sections 4.2 and 4.2.1 provide details about the TAC framework, explaining why such a tool is necessary, its formulation, the components involved, and its uses. Section 4.2.2 explains the category combinations.

4.2 TAC Framework

The methodology chapter introduced the TAC framework and its configuration, explaining how it can be used to analyse qualitative data. Subsequent sections defined components of the TAC framework and demonstrated its appropriateness as an analytical tool. One of the main intentions of this section is to illustrate the structured approach followed by this study, when analysing data using the TAC framework. An evaluation of the framework during the analysis process resulted in revising the framework to formulate a more appropriate analytical tool. According to Miles and Huberman (1994), there are three sub-processes involved in the data analysis process (i.e. data reduction, data display and drawing conclusions). By undertaking the three steps methodically (in line with the evolution of the framework), the conclusions drawn at the end are consistent and structured. The authenticity of conclusions is verifiable by tracing back to the original data source. The following sub-sections aim to demonstrate how the TAC framework facilitated the achievement of these steps.

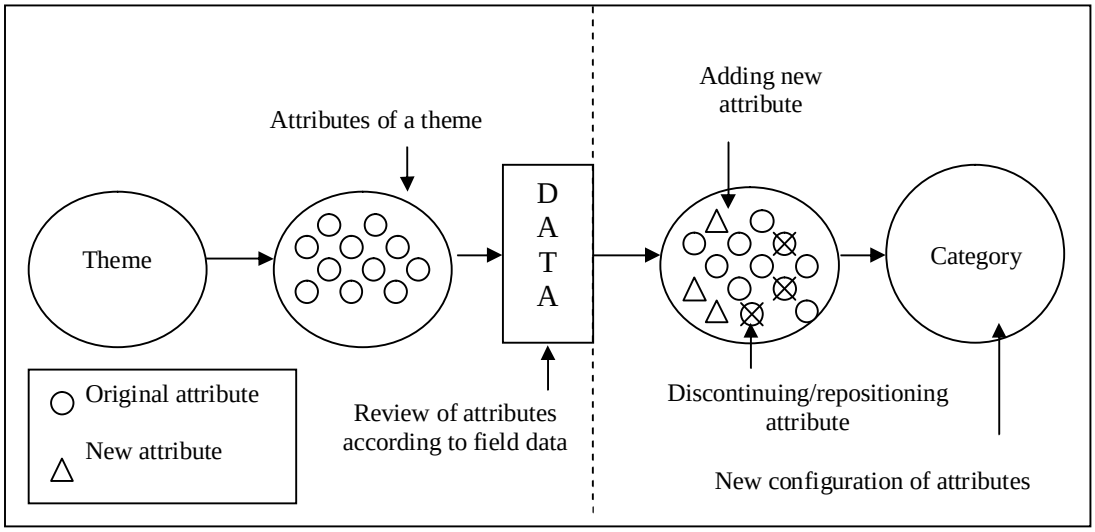
A formidable challenge in qualitative research is data management, because it requires dealing with large volumes of data from numerous sources, which can easily camouflage emerging trends. Providing a solution to this onerous challenge, the TAC framework acted as a matrix to separate data. The requirement was to break down data blocks into smaller

units but maintain a link to their original source (i.e. theme). This is discussed further in section 4.2.3.3. Data can be synthesised with data sets from other themes to reinforce emerging patterns. By using an attribute column in the framework, separation of data at a more detailed level was possible, whilst maintaining a link to the original theme.

The framework emerged naturally from the research. From the start, it developed incrementally extending over several key events such as the exploratory study, literature review, methodology formulation, data collection, and data analysis. Prior to data collection, the framework consisted of two columns representing themes and attributes (TA framework). The themes were identified from an exploratory study and the literature review. For example, discussions with academics at New York University revealed that, at the time, there was heightened interest regarding ICT impact on upstream channels (i.e. B2B). They also indicated institutions that are currently undertaking similar research in the United States of America. The foundation of the framework consists of four themes, two of which were identified from the exploratory study and two others from the literature review. As explained previously, the exploratory study identified four potential topics for investigation. (See section 1.3). From these topics, two appeared to be particularly appropriate from an academic perspective. The literature search reinforced the existing themes identified from the exploratory study as suitable research issues. The literature review outlined previous research in the selected themes. Sections 2.7.6 and 2.11 discuss the limitations of previous studies in this area.

The next development was adding an attribute column adjoining the four themes. A literature review based on the four themes revealed that each theme consisted of many attributes. The attributes for this study required selection according to the subject area and the research questions. The TA framework was revised during data collection and data analysis. Primarily the analytical process was concentrated at the attribute level. Changes to the attribute column were necessary as a consequence of data analysis. As a result of these changes, it was possible to maintain a pertinent analytical tool, which comprehensively separates data without ignoring particular sections of data. The restructuring occurred in terms of adding new attributes and discontinuing or repositioning others according to data availability and the importance of the particular insight, as depicted in Figure 4.1.

Figure 4.1 Revising TAC



The surviving groups of attributes required a label to indicate their processed state, to differentiate them from the original composition, whilst maintaining a link to the themes. Identifying the new composition by a label would be convenient to formulate discussions at later stages. The remaining classes of attributes were grouped together under four categories according to the new composition. A column containing the categories was added to the existing TA framework. Adding of the category column created the TAC framework.

4.2.1 Reasons for developing TAC

The research required a clear method for dividing the data into smaller units in terms of data sets to find appropriate answers to the research questions. Two available options were to use a conventional manual method or computer assisted qualitative data analysis software (CAQDAS) programmes such as Nudist, NVivo, and Atlas/ti. The CAQDAS option provides several benefits such as organising the data in an efficient, effective and coherent manner. This option is especially useful for dealing with large volumes of data. However, the researcher believes that the volume of data collected during field research does not warrant in itself the use of a CAQDAS program. The manual option appeared to be more suitable as it would be possible to develop a flexible, comprehensive, purpose built, innate analytical tool for this study. It was possible to gain the benefits of a CAQDAS programme even from the manual method by using the TAC framework.

The manual approach was considered more appropriate for four reasons. Firstly, at the stage of data analysis, a natural tool was already emerging from the research. The four themes used as the foundation of the research and the attributes identified from the literature review provided a useful platform to separate data. Secondly, a software programme tends to stay within fields specified at the beginning of the study whereas the manual option provides more flexibility to make changes to the research path in the light of new developments. Thirdly, a custom-built tool would be more thorough. For example, a software programme only detects explicit issues. A manual option is receptive to exploring implicit issues due to human cognition. Fourthly, the researcher prefers a tangible data processing approach, which transforms data incrementally and where he can witness the work-in-progress. The researcher prefers an analytical process, which is unearthed on paper with his involvement rather than covertly inside a computer. The researcher believes that the best insights become visible during the analytical process and therefore flexibility is a major requirement. The manual method provided a comprehensive analytical tool, which can deal with complex and interlinked scenarios prominent in qualitative research.

4.2.2 Category Combinations

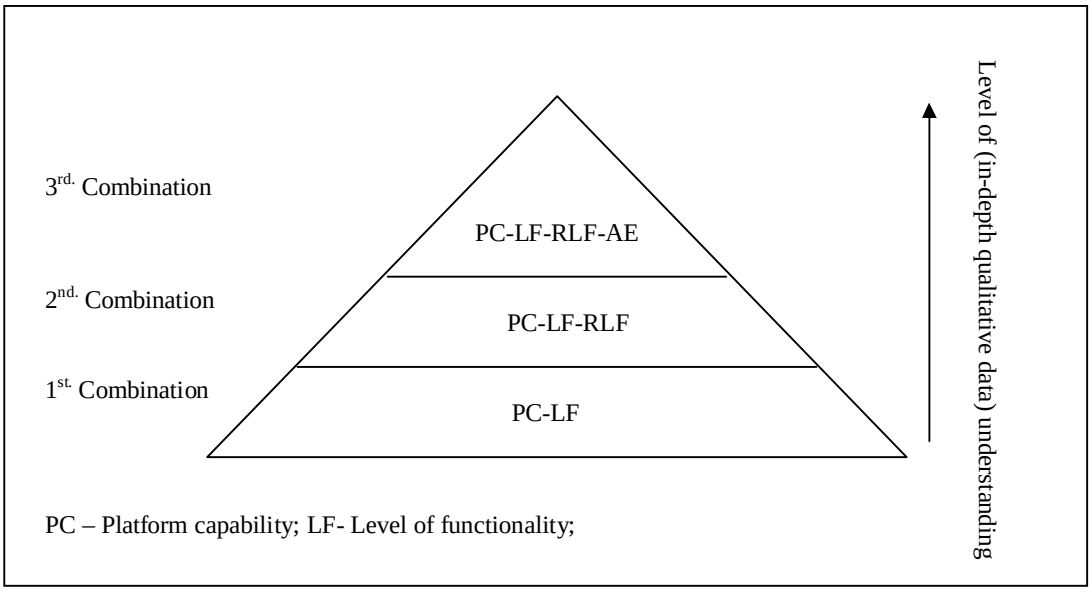
In the beginning, it was assumed that answers to each of the research questions would be confined to one particular category. For example, consider the question, 'why do some companies believe EB adds value to the organisation?' Initially, the assumption was that finding an answer to this question would be confined to Platform Capability. This assumption was made because the literature discusses an attribute such as cross-structural visibility as an important indication of the ability to communicate. In depth analysis at the attribute level revealed that, to answer this question appropriately, both Platform Capability and Level of Functionality have to be analysed. Furthermore, all of the research questions, excluding three[17], relate to two or more of the categories. Therefore, a combination of categories is required to unlock the answers to each of the research questions. A pattern emerged between four categories to form three combinations. Section 4.2.3.3 illustrates the emerging patterns that were identified. They are as follows: (1) Platform Capability (PC) and Level Of Functionality (LF); (2) Platform Capability, Level Of Functionality and Role of Lead Firm (RLF); (3) Platform Capability, Level Of

[17] The three questions were discontinued from the research at the attribute analysis stage, as the answers did not provide an adequate level of response.

Functionality, Role of Lead Firm, and Appropriateness of Expectations (AE).

From a qualitative analysis viewpoint, observing the relationship between the combinations provides greater understanding in a stage-by-stage approach e.g., the category RLF is added to the combination PC–LF to form the subsequent combination PC-LF-RLF. Here the adding of RLF facilitates deeper understanding by discussing the involvement of the customer. Figure 4.2 depicts this process. From bottom to top, the figure portrays a correspondingly deeper level of understanding regarding the impact of e-Business on SCM.

Figure 4.2 Three category combinations



In all three combinations, participant companies are grouped according to similarities and differences e.g., Company A uses a higher level of ICT compared to Company D. A direct comparison between these two companies will facilitate only an individualistic understanding of a participant company. Alternatively, one can consider that Company A and C use a similar level of ICT, which is different to Company D and E's usage level. By comparing the two groups (i.e. A, C and D, E), it is possible to identify underlying reasons such as influence from the product profile and relationship with customers for ICT implementation. In terms of ICT, Company B has a lower level than A and C and a higher level than D and E. Therefore, Company B is positioned between the two groups.

4.2.3 Definitions

Interchangeablility or vagueness of a term can hamper a clear understanding of a discussion point. As anticipated, this study contains numerous acronyms and the area of research includes ambiguous terms yet to be clarified by academic literature. It may be useful to clarify terms such as themes, data matrix and data files, as used in this research, because the following sections use them as key words.

4.2.3.1 Themes

According to the Oxford English Dictionary (OED) (2001), the origin of this word is from the Latin word *Thema* meaning a recurring pattern, which can be prominent within a subject area. The OED defines a theme as 'a topic of discourse or discussion'.

The term 'theme' was first identified at the exploratory study stage of the research. The exploratory study used open-ended questions and inquired 'what are the prominent topics in the subject area of ICT usage in SCM?' The interviewees responded with several 'themes' that have taken their interest.

4.2.3.2 Attributes

According to the OED (2001), this word has it origins in the Latin verb *attribuere* meaning 'assign'. As a noun, the OED defines this word as 'a quality or feature regarded as a characteristic or inherent part of someone or something'.

The term 'attribute' was identified at the literature review stage of the study. A literature review based on the four themes revealed that many attributes characterise a theme. Attributes are aspects and selecting a particular set of attributes (inherent in a theme) would determine the direction of a theme. Selecting only relevant attributes helped to refine the research themes. According to the research focus, only some attributes are relevant to this study. This study selected attributes according to the subject area of the impact of ICT on SCM. The research questions reinforced the selection of suitable attributes. For example, authors such as Van Hoek (2001) and Chaffey (2002) note how conventional understanding of the term 'information sharing' is now changing due to the 'cross structural visibility' facilitated by new types of ICT. Therefore, 'cross structural

visibility' is an attribute of the theme 'information sharing'.

4.2.3.3 Categories

The term 'category' was identified during the data analysis process. It served the purpose of labelling the processed state for a group of attributes. According to the OED (2001), this word came from the French word *catégorie* or the Latin word *categoria* meaning 'statement'. The OED defines this word as 'a class or division of people or things regarded as having particular shared characteristics'. In this study, a category represents a class of related attributes selected according to the data analysis process.

During the data analysis process, changes occurred in terms of adding new attributes, discontinuation of attributes and repositioning of attributes. The new configuration of attributes is represented by a category. Changes to the attributes and labelling of categories occurred simultaneously. The labels are assigned according to the particular meaning. For example, platform capability represents the capability of the company communication system etc. Tables 4.1 and 4.2 outline the configuration of the attributes before and after the data analysis process.

Table 4.1 Framework before data analysis

Theme	Attributes
Level of information sharing	Quantity of information Communication platform integration Accessibility of information Cross structural visibility
Type of information sharing	Operational Tactical Strategic
Buyer supplier relationships	Effects on BSR Shift in communication with different ICT
Actual vs. Perceived impact	Anecdotal benefits Anecdotal problems Hyperbole contributing to industry perceptions

Table 4.2 Framework after data analysis

Themes	Attributes	Categories
Level of information sharing	Quantity of information Accessibility of information Cross structural visibility Data filtering Security	Platform capability
Type of information sharing	Operational Tactical Strategic Shift in communication with different ICT	Level of functionality
Buyer supplier relationships	Effects on BSR ICT implementation Access control	Role of the lead firm
Actual vs. Perceived impact	Communication platform integration Anecdotal benefits Anecdotal problems Hyperbole contributing to industry perceptions	Appropriateness of expectations

Attributes relating to the theme 'level of information sharing' changed because the data analysis process identified two new attributes: 'data filtering' and 'security'. The other change was repositioning the attribute 'communication platform integration' under the theme 'actual vs. perceived impact'. This change was made because the data suggest that there is high level of hyperbole regarding the achievement of integration. The theme 'actual vs. perceived impact' discounts for hyperbole. Section 7.4 provides further discussion on the extent of hyperbole.

The attributes relating to the theme 'type of information sharing' changed because the attribute 'shift in communication with different ICT' was added. This attribute was taken from the theme 'buyer supplier relations' and repositioned under 'type of information sharing'. The other change was adding the new attribute 'negotiations'. However, this attribute was later removed because it can be discussed under the attribute 'tactical'.

The new attributes 'IT implementation' and 'access control' were added to the theme 'buyer supplier relationships'. The theme 'actual vs. perceived impact' was changed by adding the attribute 'communication platform integration'.

During the data analysis process the category combinations were identified from emerging patterns in the data as depicted by the diagram in Table 4.3. This means that the answer to a research question relates to several attributes relating to two or more of the themes. In other words, interviewee responses refer to several attributes when answering a research question. This creates data synthesis between the attributes. For example, consider the following question:

- Why do some companies implement new ICT tools such as e-Business?

Regarding this question, the group head of ICT at Company B commented that ICT implementation is about giving more access to the customer. He stated that: "At the planning stage we allow them [customers] to see in terms of the cost sheet, material make and so on, but not at the production stage. At the moment we do not allow them that facility… It [access] is a decision we have to make. Whether we are going to allow them in to the system. No sooner you show them everything, they are going to get really demanding…"

This interviewee's quotation synthesises data belonging to the attributes: cross structural visibility, operational, tactical, strategic and access control. These attributes belong to three themes: level of information sharing, type of information sharing and buyer-supplier relations. Regarding this question, other interviewees provide responses synthesising data belonging to the attributes: quality of information, accessibility of information and cross structural visibility; operations, tactical and strategic; and effect on BSR, ICT implementation and access control. In Table 4.3, a bold line indicates the data synthesis.

Table 4.3 Identifying emerging patterns during data analysis

Themes	Attributes
Level of Information sharing	QI, AI, CSV, DF, SEC
Type of Information sharing	Ops, Trans, Strg, SCDICT
Buyer Supplier Relationships	Ebsr, Imp, AC
Actual vs. Perceived impact	CPI, AB, AP, Hyp

CSV - cross structural visibility, AI - accessibility of information, QI - quantity of information, DF - data filtering and SEC – security; Ops- operational, Trans – transactional, Strg – strategic and SC - shift in communication with different ICT; Ebsr - effects on BSR, Imp - ICT implementation and AC - access control ; CPI - communication platform integration, AB - anecdotal benefits, AP - anecdotal problems and Hyp -Hyperbole contributing to industry perceptions

The data analysis process using the attribute column provided more clarity to identify the emerging patterns.

4.2.3.4 Data Matrix

The TAC framework is a data matrix and it separates data according to the sixteen attributes working under the four themes. The components of the first two columns of the TAC framework were arranged in a landscape format to display data availability as depicted in Appendix Z. Horizontally, from left to right, the twelve attributes are listed under each theme. On the left side axis, from top to bottom, each of the thirty-five interviewees is listed according to their job designation[18]. The objective is to maintain simplicity and obtain visualisation of the available data. The matrix operates as a set of mail-sorting pigeonholes, allocating data units into each box using a tick to acknowledge data availability. As mentioned before, parallel to the data analysis process the TAC framework was evaluated. The TAC framework was modified according to insights from

[18] An expert interviewee provided two interviews as he was working for the Sri Lankan Government as well as in a private organisation. This interviewee is marked with an asterisk in the left hand column in the data matrix.

interviews. As a result of recording the changes, a comprehensive summary of the available data was displayed by the data matrix.

4.2.3.5 Data Files

Compiling a document, which would provide a detailed overview of a particular company, appeared useful. The data files provide a complete account of comments made by interviewees of each participant company. Each data file has a data matrix at the front of the document to depict a summary of attributes ticked by a particular company. From observing a company data file, it is possible to see to what extent the company mentioned a particular attribute or whether it was mentioned by only one interviewee. Using the data files had several benefits. Identifying the level of management responsibility, similarities in approach across companies, areas of interest (from the four themes) for a company, areas they ignore, and cross-referencing for data verification purposes, were some of the benefits gained from using data files.

4.3 Interrelated chapters - Link between the category combinations

This section explains how a greater level of data analysis is achieved using the category combinations. The data analysis suggests that there is a progressive relationship between the category combinations. Figure 4.3 part (A) diagrammatically depicts the links. The link between PC-LF with PC-LF-RLF identifies ‘why’ manufacturers implement ICT tools. Here internal reasons are identified by the first combination and the second combination identifies the external reasons. Figure 4.3 part (B) visualises how this method can provide a deeper level of analysis.

Figure 4.3 Link between the combinations

Part (A)

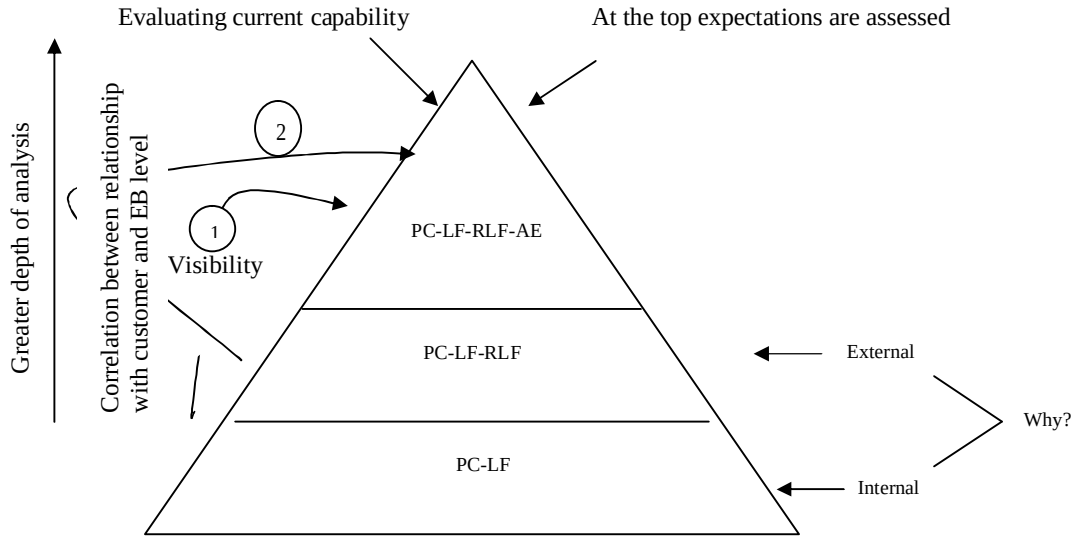
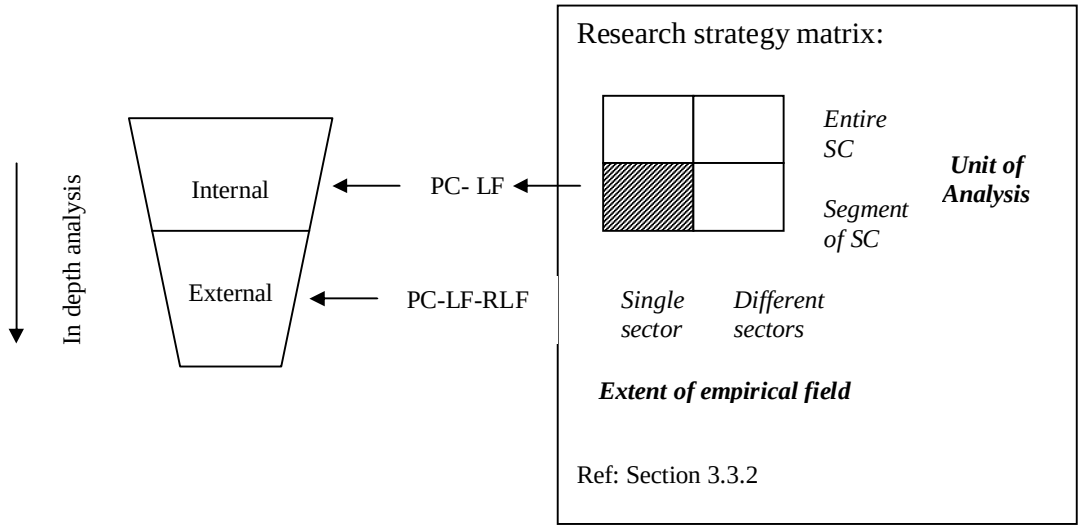


Figure 4.3 Part (B)

Zoom in to analyse 'Why companies implement ICT?'



The research strategy matrix (see Section 3.3.2) provides four possible alternatives, namely: entire SC in a single sector, entire SC in different sectors, segment of SC in a

single sector or segment of SC in different sectors. This study focuses on one segment of the SC in a single sector. The chosen segment of the SC is manufacturing and the sector is apparel. This means that the research strategy focuses on observing the manufacturer's point of view. In part (b) of Figure 4.4, this quadrant is identified by the shaded area. The data analysis starts from identifying internal reasons at the manufacturer and then extends to identifying external reasons. This provides a greater depth of analysis to determine 'why manufacturers implement ICT'.

The first combination, PC-LF, is used to identify over 21 benefits of ICT, from which 'visibility' appears to be the main advantage. Part (a) of the diagram focuses on 'visibility', as illustrated by the connection between PC-LF and PC-LF-RLF-AE as indicated by the first link. In Chapter 7, the third combination, PC-LF-RLF-AE, is used to appraise visibility and to examine the EB capability of manufacturers.

The second link, between PC-LF-RLF and PC-LF-RLF-AE, is used to identify the connection between customer relationship and EB capability. The second combination, PC-LF-RLF, is used to discuss the external influences and the significance of relationships in implementing ICT tools. The third combination, PC-LF-RLF-AE, examines the significance of relationships by positioning the manufacturers according to their EB level and the relationship strength with the customer. The third combination also provides a more suitable platform to evaluate EB capability because it discounts hyperbole and anecdotal claims.

4.4 Preview of the findings chapters

At this stage, it would be useful to understand how the research questions are answered. Table 4.4 summarises how the research questions are answered in chapters 5, 6 and 7.

Table 4.4 Answering the research questions

Category Combination	Research questions	Discussion	
PC – LF Chapter 5	1. Why do some companies believe e-Business adds value to the organisation? 2. What are the benefits of e-Business? 3. How important is information sharing in the apparel supply chain?	Positives	
	4. What are the negative aspects of information sharing, if any?	Negatives	Barriers
PC –LF –RLF Chapter 6	5. Why do some companies implement new ICT tools to facilitate e-Business? 6. Who influences the decision to migrate to a new ICT system?	ICT implementation	
	7. Who controls the information sharing policy? 8. How can suppliers preserve competitiveness in a total information transparent supply chain? 9. What type of information sharing policy do they use?	Access control	
PC –LF –RLF-AE Chapter 7	10. How do current e-Business users position themselves in terms of usage?	Current status	
	11. What criteria can be used to evaluate an ICT tool?	Evaluation	
	12. Why do companies have high expectations from new ICT such as e-Business?	Expectations	

The first column lists the category combinations PC-LF, PC-LF-RLF and PC-LF-RLF-AE. The second column lists the research questions. The third column represents the discussion points.

In Chapter 5, the first category combination PC-LF is used to appraise capability and functionality of ICT in the current working environment. This provides an overview of the situation by assessing advantages and disadvantages by comparing old and new types of ICT. The answers to the research questions 1-4 are discussed from the manufacturer's internal perspective. The findings are discussed in terms of *positives*, *negatives* and *barriers* for information sharing and ICT implementation.

Chapter 6 attempts a deeper level of analysis. This chapter answers the research questions

5-9, considering the customer, taking an external view. It builds on the first combination by adding 'RLF' (role of the lead firm) to present data under the second combination PC-LF-RLF. This combination reveals the involvement of the customer as the lead firm in the SC. It explains the lead firm's role in terms of the decision-making processes for ICT implementation and control of the information flow. Note that in chapter 6, further questions are developed in presenting the findings to improve the flow of the discussion. For example, how does the relationship strength impact on the ICT implementation process? and why did you specifically implement this brand of technology? This chapter is presented in two sections, namely *ICT implementation* and *access control*.

Chapter 7 presents findings, proceeding to a further level of analysis, by incorporating elements such as interviewee perceptions and hyperbole. It builds on the second combination by adding AE (appropriateness of expectations) to continue discussion under the category combination PC-LF-RLF-AE. The aim is to discuss some of the prevailing issues regarding ICT usage in SCM. It presents data in the areas of *current status*, *evaluation* and *expectations* of e-Business.

CHAPTER FIVE INFORMATION SHARING: PC –LF

5.1 Introduction

The purpose of this chapter is to discuss the ICT systems used by the manufacturers investigated in the fieldwork. The findings are presented in three sections, which outline positives, negatives and barriers to using new ICT by comparison to previous forms of ICT. Tables 5.1, 5.2 and 5.3 list positives, negatives and barriers respectively. The first two categories in the TAC framework (i.e. platform capability and level of functionality) are combined to derive the combination PC-LF. PC (platform capability) examines the scope of the ICT systems, for example, how much information the system can hold, coverage of the connectivity and robustness of the security. LF (level of functionality) means the extent to which the system is being used, for example, how the ICT is used at different levels of activities such as operational, tactical and strategic. The purpose is to understand whether there is a deficit between the capability and functionality of ICT tools. For example, in the case of Company C, they have the capability to track the finished goods at sea. However, they practice FOB (Freight on Board). Therefore, it is not necessary for them to acquire that degree of information. In this case, the capability of Company C's ICT exceeds their requirements. Section 7.3.2 in Chapter Seven discusses this in more detail. The first combination (PC-LF) creates a foundation to continue discussions in the subsequent two chapters.

One objective of this chapter is to identify similar characteristics between the manufacturers for the purpose of grouping. This chapter undertakes grouping according to EB capability and functionality. The subsequent chapter aims to reinforce the grouping, according to the relationship strength with the customer.

The data collected from research questions 1-4 suggest that there is a link between platform capability and level of functionality. This chapter provides answers to the research questions in three sections. The findings presented in the third section are derived from all four questions.

Section One:

1. Why do some companies believe e-Business adds value to the organisation?
2. What are the benefits of e-Business?
3. How important is information sharing in the apparel supply chain?

Section Two:

4. What are the negative aspects of information sharing, if any?

Section Three: Additional information provided by the interviewees in answering the above questions was used to create Section three.

The first section provides answers to three types of questions[19]. The answer to the 'why' question examines internal reasons for manufacturers to be in favour of EB (e-Business). The discussion in the next chapter outlines the external reasons why the manufacturers implement EB.

The second section examines the problems created from using EB. The data analysis identified nine negative points. The negative points vary between the manufacturers, except for the security issue. Sections 5.3.1 and 5.3.2 discuss two of the negative points. The other negative points are discussed in Section 5.3.3.

The third section identifies five issues acting as barriers that prevent manufacturers from using ICT.

Section One

5.2 Positives

The first section outlines the benefits of using ICT tools such as EB. The data analysis

[19] Note that the first and second research questions are different because the findings from the first research question present a strategic view whilst the second research question observes an operational and transactional perspective.

identified over twenty reasons why the manufacturers believe EB adds value to their organisation. Sections 5.2.1 – 5.2.14, discuss the most important benefits. Section 5.2.15 discusses other benefits. Table 5.1 outlines the benefits as indicated by the manufacturers. It is possible to ascertain the EB capability of the manufacturers by observing this table. A design feature of the table is that it outlines the important benefits at the top end from point 1 to 14. According to the data, only two companies are able to achieve an advanced benefit such as visibility or disintermediation.

5.2.1 Visibility

In the spectrum of benefits facilitated by ICT, visibility to and from the customer is perceived as being of high importance. However, data suggest that out of the five companies, only A and C have visibility. This is because Company A uses ICT tools such as FFRA (freight forwarder reverse auctioning)[20], RTS (resource transition system)[21], and Cross Decking. In the case of Company C, ICT tools such as VMI and CPFR give them visibility. Company A is able to provide internal visibility (i.e. inside the factory) with the RTS and achieve visibility with external entities through FFRA and Cross Decking[22]. In the case of Company C, their customer provides visibility of the sales floor with the VMI. When an item is sold at their customer's store, Company C is aware of that sale within seconds. This provides Company C with a high level of visibility of their customer. At the same time, Company C's customer is able to keep track of the production floor at Company C using CPFR. The CPFR tells the customer how much of the order is completed and when the shipment will arrive to replenish the stocks. It appears that the ICT capability at Companies B, D and E is not as high, compared to Companies A and C. In the case of Company B, they have started implementing EB recently. According to the data, Company B has the necessary infrastructure to achieve the benefits available to Companies A and C. The data suggest that currently only Companies A and C benefit from visibility. This is clear from the following comment made by the commercial manager at Company A: "You must have heard about our new initiatives: Cross decking and FFRA. Both these initiatives give us visibility to communicate with our SC partners. Now without them I would have to be

[20] FFRA is used for trading finished goods.
[21] RTS is a production-monitoring tool used in-house to identify process efficiency levels.
[22] Cross decking is used mainly with the customer for informing stock availability.

on the phone much longer than I do now".

In the case of Companies A and C, it appears that they have little concern about incurring a negative effect from sharing a higher level of information because of visibility. The data suggest that visibility helps to synchronise activities such as lead times and deliveries. The IT manager at Company A commented that visibility is positive rather than negative because other entities in the supply chain are able to work with the same set of data: "I don't see anything negative on that [information sharing]. I can only see positives of that. I think it's always better to work on a formal set of data because when the information is not transparent, entities in the SC will have different sets of figures and ultimately we'll be working with different lead times, add-ups (cost details) and things like that".

Similarly to Company A, Company C appears to be in favour of practising visibility. The data suggest that a main benefit of new ICT such as EB is the ability to see information across the organisational structure. As a result, the customer's needs are identified faster and this facilitates forward planning. By avoiding unnecessary production, waste can be eliminated. This also provides information about what is selling fast at the customer's store. As a result of this information, Company C is able to chase new orders ahead of their competition. The planning manager at Company C claims that he was able to win US$1.5 million worth of extra orders because of this. The following comment by the planning manager at Company C provides evidence of this claim: "Cross structural visibility has created several advantages for the manufacturer. It helps us with forward planning, minimises waste, chases orders, and gives us visibility of what is happening. This is crucial, as they do not tell us what is going on sometimes. Because of VMI I have managed to get US$1.5 million of extra orders". It was interesting to examine how this extra order worth US$1.5 million can be attributed to VMI. When the planning manager at Company C was asked how this [extra orders] could be attributed to the CPFR/VMI system alone, he replied: "Simply the visibility wouldn't have been there for me to chase those orders".

Table 5.1 Comparing current ICT with previous ICT

Positives	*Company A*	*Company B*	*Company C*	*Company D*	*Company E*
1. Visibility/Transparency	√		√		
2. Cost reduction	√		√	√	
3. Disintermediation	√				
4. Reduce work load	√	√	√		
5. Faster cycle time	√	√	√	√	√
6. Real time information	√		√		
7. Problem prevention/early detection	√		√		√
8. Accuracy of information	√	√	√	√	√
9. Clarity of information	√	√	√	√	√
10. Quantity of information	√	√	√		√
11. Informed decision making	√	√	√		
12. Type of interaction	√	√	√		
13. Better rapport/relationship		√	√		
14. Staff learning new skills			√		
15. Global reach/ access				√	
16. Direct contact to intended person/party		√		√	
17. Acknowledgement/ confirmation of delivery				√	
18. Record of previous communication				√	
19. Traceability				√	√
20. Frequency of sharing information					√
21. User friendly			√		
√ *Indicates response from the participant company*					

The issue of visibility appears to be important because only manufacturers with advanced ICT tools seem to achieve this benefit. The data suggest other manufacturers are aspiring to practise a high level of visibility. According to the data, there is an urgency to facilitate visibility after the MFA. All the manufacturers agree that after the MFA, customers will only use manufacturers with a high level of visibility. This is because a SC with a high level of visibility appears to operate with fewer communication breakdowns. Section 7.2.2 in Chapter Seven discusses the visibility aspect in more detail.

5.2.2 Cost reduction

Companies A, C and D talk about benefiting from cost reduction due to their use of ICT. Perhaps it is not surprising that Companies A and C are able to reduce their communication costs because they have advanced ICT tools, which enable them to avoid using expensive conventional communication methods such as fax and telephone. The following comment by the IT manager at Company A outlines this point: "One thing would be the cost. There was a time where we had to make two IDD calls a day to Hong Kong. Now actually we are going through the net. So cost, I would say, is a main advantage and the scope is also larger with e-Business …".

It appears that use of e-mail has enabled Company D which has a sourcing arm in Hong Kong to cut costs on communication. Company D believes that without an ICT tool such as e-mail their internal communication costs would be much higher. The merchandising manager at Company D provides the following comment to outline cost reductions: "The advantage of new ICT compared to previous is mainly cost, fast response and acknowledgement…We don't pay anything for e-mail, or video conferencing. If we only have telephone and fax, the cost would be much higher …". The data suggest that the cost of sending a fax or making a telephone call is significantly higher than sharing information through an e-mail or video conferencing.

The trend of enjoying cheaper communications is set to improve further due to competition among the network providers. For example, in Sri Lanka mobile phone network providers such as LankaBell provide national business calls free of charge. According to an expert[23] at ICTA in Sri Lanka ICT, methods such as 3G would create more competition for fixed line communication providers, which would result in even cheaper communication charges. According to experts from ICTA, eWave[24] and Hong Kong University e-Business technology Institute[25], as the use of digital technology increases, the cost of communications will reduce even further.

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[23] Programme Specialist: ICT Investment/Private Sector Development.
[24] CEO: eWave corporation private limited: offshore software development (outsourcing) and processing (operations).
[25] Assistant director: E-Business technology institute The University of Hong Kong: Technology Innovation and Incubation division.

5.2.3 Disintermediation

Disintermediation is the cutting off (or skipping) of one echelon in the supply network (Slack *et al*, 2004:167). This ability brings benefits in the form of reducing cycle time, better information delivery and reduces cost by eliminating the unnecessary entities in the channel. It appears that out of the five companies, only Company A is currently taking advantage of their ICT to undertake disintermediation. Company A is able to practise disintermediation because they use Cross Decking and FFRA. Using these tools, Company A practises a 'pull system' of control. Here, the customer of Company A is able to see a comprehensive picture in terms of available finished goods and work in progress. According to his requirements, the customer is able to pull out stocks from the manufacturer. The following comment by the IT manager at Company A explains how they achieve disintermediation:

"We have two applications in place now. One is what you call cross decking, where we give the customer access to our finished goods stocks and inform customers to place orders whenever they run out of stock. Say in a store, if they are running out of stock, with this they can look at our inventory here and place orders directly to those stores, even bypassing the distribution centres [i.e. disintermediation]. That is one application. The second is an extension of the first application. The first application we have developed currently only caters to the finished goods but we want to develop to show the work in progress in the sewing as well as cutting, so they see a complete picture. So they will know even in its cutting stage when it will come out so they can place orders for their stores. That differs from the VMI in the sense that the VMI vendor looks at the customer inventory and tries to replenish that. Here the customer looks into the vendor inventory to pull out the stocks".

In the case of Company C, VMI and CPFR are the main ICT tools. Using these tools Company C is able to practise a 'push system' of control. The CPFR tells Company C how much is sold at the customer. According to this information, Company C pushes goods to the customer to replenish the stock. With the information provided from the CPFR, Company C is able to practise disintermediation in terms of ordering goods from raw material suppliers. However, Company C is unable to take advantage of the disintermediation capability because the customer decides which suppliers to use.

5.2.4 Reduce workload

Of the five companies, three companies claim that new ICT has changed the way data entry is practised. Companies A, B and C claim that, because of automatic data entry, the workloads have reduced. Previously, when they were using conventional tools such as fax, order details had be to manually entered into the systems. Entering details automatically requires fewer workers. By avoiding human intervention, errors are minimised. Section 5.2.8 discusses the reduction of errors in more detail. The following comment by the materials manager at Company A provides evidence for this claim:

"I would say it [information sharing] helps reduce the work load. Before, when we got the documents, we would have to enter everything to the system, which would require additional manpower but currently we don't need to do that…certain information from Triumph is also transmitted through EDI such as the BOM which comes through EDI and the PC information. Actually, it has helped us to reduce the work load because things are coming though EDI and it's directly transmitted to our system…".

In the case of Company B, they have just completed the infrastructure necessary to conduct EB. The data suggest that previously they had to undertake more manual work than at present. For example, Company B had to enter details to make stickers to put on the finished goods boxes. By using ICT tools such as EDI the product details automatically enter the system. This means that the stickers are automatically printed without any involvement from the manufacturer. This suggests that because of new ICT the manufacturer is able to reduce the workload and concentrate on production. The IT manager at Company B commented: "…Without EDI we have to develop the sticker here…That is less work for us, so we can concentrate on production and other things. Especially for the packaging department it's a relief and of course the shipping department benefits because all the information important to them is there".

In the case of Company C, they claim that the evidence to indicate reduction of the workload can be found by looking at their worktables. Company C indicates that prior to using advanced ICT their worktables used to have piles of documents. The IT manager at Company C stated: "We never had technology as such, just e-mails. Before we had the link, all the information was communicated through e-mail. You can probably imagine the number of e-mails our departments got. It was very messy".

The data suggest that new ICT methods have considerably reduced the workload in terms of data entry, frequent communications and sorting data in to relevant fields. According to the data, only companies A, B and C currently enjoy this benefit. The data suggest that companies D and E face difficulties entering data in to their systems. This issue is discussed further in section 7.3.2.

5.2.5 Faster cycle time

Improving the speed of communication is an apparent benefit of electronic communication because it delivers information much more rapidly than conventional methods. All five companies agree that faster cycle time is a major advantage of new ICT. In the case of Company A, they are able to deal with quality issues earlier than before. This is because the problem can be shared immediately and as a result the speed of response is also swift. Illustrating this point, the materials manager at Company A commented: "…At times when we have a quality issue on a fabric, we are able to take a digital photograph and e-mail the supplier rather than them waiting for the sample to come over…".

Company B expresses a similar sentiment about getting faster response to resolve difficult areas. It appears that the time scale required for getting a job done has reduced significantly. The reduction of the cycle time is important in this industry because fashion trends constantly change. Achieving a shorter cycle time would enable faster replenishment of stock. The following comment by the CEO of procurement at Company B outlines this point: "E-mail communication has changed everything. You send a video clip and things get done much faster. What used to take months now only takes a few days. About five years ago, it took about 150 days from when we got the order. Now if you are doing entire fabric sourcing it is about 60 days turnaround we are asking. Five years ago, we used to ask for 120 days from the time when we get the fabric in house. We had that amount of time. The whole thing has become faster".

Company C also claims that they have experienced time savings from using new types of ICT. Additionally, Company C indicates that people are more likely to communicate if the process is quick. This suggests that users are motivated to respond promptly if the communication tools work fast. The IT manager at Company C commented: ". …E-mail as an ICT has created a major difference in the way we communicate. Within

seconds, you can share your information with suppliers and customers and get replies within minutes…. you can download relevant information, make reports, send it to your suppliers in the time period that it used to take to send a fax. When the speed is high naturally the level of communication improves, I think. People will communicate with other parties as long as it does not take too much of their time and the process is user friendly".

In the case of Company E, they do not have advanced ICT tools such as VMI or FFRA. However, Company E claims that they are able to reduce the time taken for troubleshooting by using digital technology and e-mail. It appears that new ICT tools have reduced the time taken to communicate with external parties in the SC. The IT manager at Company E explained: "If you take the garment industry, when you order something the order material sometimes comes with some damages. So you have only two weeks to complete your order. So if you don't communicate with the supplier promptly you'll be in big trouble. You will have to pay penalties for the whole order. In a case like that we can use digital camera, film and straight away send them [customer/supplier] the photographs. So if we didn't have a proper communication system like sending pictures through e-mail we wouldn't be able to do the business, especially in the garment industry".

According to the data, in terms of product development, ICT has reduced the cycle times significantly. The ability to share visual data online has eliminated the requirement of physically sending the sample to the customer. This means that the cycle time has reduced by the sample courier time as well as time taken for communicating any changes. The data suggest that using the online method is an interactive process, which provides solutions much faster. The following comment by the merchandising manager at Company E provides evidence to back up this claim: "Compared to what life used to be those days vs. now, ICT has made things easier. Especially in terms of development, we get our development online, the sketches and everything, so you have visual. There are instances where I have a problem with colour matches. Those days we would have had to make a swatch, courier it and wait for them to see the colour differences…I have no choice but to keep production on hold for a week until the customer sees both swatches and then says 'you know what, I think it is ok to go ahead', losing one week's production, you lose your delivery target… What we do now is we put it on a dummy and video conference it and they get to look at it and you get

feedback much faster".

The data suggest that all five companies enjoy the time reduction from the order cycle. They claim that because of visibility facilitated by new ICT, problems are resolved much faster. Ability to operate the communication tool, moreover, quickly motivates the employees to respond promptly.

5.2.6 Real time information

The information from new types of ICT appears to be more frequent and up-to-date than traditional communication technologies. The data suggest that the ability to follow transactions and other activities as they happen provides a greater sense of control for the recipient. According to the data, the main benefit of real-time information is that it improves the reaction time. Real-time information enables a company to deploy a contingency plan at an earlier time, to achieve a favourable outcome. Findings suggest that only Companies A and C have the EB capability to achieve real-time information. It appears that with the exception of Company B, the other companies do not have the infrastructure or the tools to share real-time information[26]. For Company A, getting a live transmission of data from their customer enables them to organise operations accordingly.

In the case of Company C, real-time information has made a significant difference to the way they conduct operations. For example, Company C practises a 'push' system of control using the VMI/CPFR programme. In order for Company C to replenish stock at the right time, they need to get a live update of the sales at a customer's store. The real-time information allows them to understand what items are in demand. In addition, it cuts costs by eliminating waste of raw materials because if a fashion is not selling well, the production floor is immediately informed so they can focus on a faster selling fashion. The following comment by the planning manager at Company C outlines the benefit from real-time information: "We do make to order and it's all in just in time (JIT). My job is to make sure the stocks are replenished according to what items are

[26] According to an expert interview conducted with the E-Business technology institute at Hong Kong University, linking real-time information with interactivity would further enhance the use of this type of ICT. Such a tool would collect information from relevant entities in the SC. This means that there is potential for complete information to flow through the SC.

selling well. It is a live system. All items are bar coded so we know what is selling and what is selling fast…".

The data suggest that a production system such as JIT requires a high level of information on various aspects including delivery times, material stock levels, work in progress and finished goods packaging. It appears that getting up-to-date information ultimately benefits the decision-making process.

5.2.7 Problem prevention/early detection

According to the data presented so far it appears that Companies A and C enjoy more benefits from EB than the other three companies. It was surprising to find that in some instances Company E was able to prevent problems early, like Companies A and C. This was an unexpected finding because Company E has the lowest EB capability and uses only very basic ICT tools such as e-mail. This suggests that even a simple ICT tool like e-mail can deliver this benefit when it is used effectively. It seems that if Company E is able to achieve this benefit, Companies B and D (owning a higher level of ICT than Company E) should also be able to achieve the same benefit through prudent use of their ICT tools. The communication standard of Company E is further discussed in section 7.2.3.

The data revealed that Companies A, C and E practise benchmarking so they share management methods. However, it is useful to note that the group that owns Companies A and E, do not own Company C. The respondents from Companies A, C and E claim that, because of new ICT, early detection of problems is possible. More importantly, they claim that preventive methods can be implemented before the problem is aggravated. For example, a material shortage at a particular stage in the production line could create a bottleneck that halts the whole production process. Fast communications provided by new types of ICT, such as the RTS system, enable early detection of bottlenecks. This means that as soon as the problems are identified, alternatives can be put in place. A system such as RTS also enables a manager to view the individual performance level of employees. The performance levels are monitored in terms of efficiency levels. If the efficiency levels in a particular production area are reduced, the manager gives immediate attention to resolve the problem. During the data collection it was observed that inside the factory of Company A several line supervisors patrol the

production lines with a palm top device. This device graphically indicates the efficiency level of that section. The regular reasons for bottlenecks appear to be machine breakdowns, raw material stockouts, and changeovers. Outlining this point the commercial manager at Company A provides the following comment: "I can evaluate the performance of individual employees with the RTS. The main purpose is to see where the bottlenecks are occurring so I can sort things before it gets serious. Sometimes it could be that one particular member of staff is too chatty with another member or a bigger problem like the machine not working properly...So without fast communication this would probably not be possible".

In the case of Company C, the use of advanced ICT provides them the opportunity to resolve problems more quickly. According to the data, one reason for problems to get resolved more quickly is that relevant authorities are able to join in to prevent problems happening. In this regard the merchandising manager at Company C commented: "E-mail has improved communication a lot. It has created cross-company communication in all levels of the company. More people are communicating. More departments are getting involved. We are able to stop a problem before it happens…".

In the case of Company E, use of basic tools such as e-mail has enabled them to achieve this benefit. An example provided by the merchandising manager suggested that use of traditional methods such as telephone or fax would not have facilitated this favourable situation. A key feature of e-mail is the CC (carbon copy) facility. This allows multiple recipients and each recipient is able to see the email addresses of every other recipient. Because of this the merchandising manager at Company E was able to detect a problem and act proactively to prevent a stock-out situation at their customer. The Company E merchandising manager stated:

"A customer had booked an order for five colours. Out of five colours …they had picked one particular colour as the main theme…The raw material supplier thought it important to inform the customer ahead of time that there was a problem in achieving a particular colour [out of the five colours]… The customer is saying 'do not worry' out of the five colours it's only one colour'... But they [supplier] raised the flag, I looked at it and I was just a CC. I was not the primary recipient. For some reason they have put me on and I had a look at it… Now if they [supplier] could not CC me in I would not have picked it up. What would have happened was we would have ordered the raw

material for 50,000 garments. We would have wasted so much. The loss of time, loss of production and then most importantly the customer would not be able to get their flow plan because it is too late to re-order everything…".

It appears that a heavy loss was avoided by preventing a problem at an early stage. This suggests that due to early detection employees act proactively to resolve embryonic problems. According to the above example, a key feature of new ICT such as CC and document attachments helps SC processes such as procurement to be more informed. Section 5.2.4 outlined how workload is reduced with new ICT. According to the data, the ease of using a communications tool determines the extent to which an employee uses that tool. This means that if a communications tool can be easily utilised the chances of an employee using that tool to act proactively would be high.

5.2.8 Accuracy of information

According to the data, ambiguous details delay the whole order cycle. For example, a handwritten document such as a fax could create ambiguity of the content due to legibility problems. While Section 5.2.9 discusses the usefulness of clear information, in this section the focus is on errors related to human intervention. All five companies agree that new ICT provides better communication in terms of more accurate information. The data suggest that sharing accurate information has a positive impact on the relationship between the manufacturer and the raw material supplier. This could be because they have reduced the waste of unnecessary purchases and returns. According to the materials manager at Company A, faster response time and accuracy of information are strengths appreciated by their supplier. He commented:

"I think in purchasing we are well ahead of the competition. That's the feedback we got from our own supplier because our response time is much faster, accuracy of our information is far better and also the way we deal with supplier relations is also quite different because we treat our suppliers the same way we treat our customers because they are equally important to the business. So I think our communication is far ahead of our competitors".

Affixing labels or stickers on the finished goods boxes is an important part of the packaging process. The stickers provide an inventory of the goods as well as additional

details about the product. According to the details on the stickers, the delivery is made to the relevant store in the customer's country. A serious responsibility for the manufacturer is to put the correct details on the stickers. Using ICT such as EDI the customer is able to send exact details so the manufacturer can print out from his side. The manufacturer still has the responsibility for the delivery being correct. This process reduces responsibility (sharing product specification information) and time, and also improves the accuracy of the information on the stickers.

According to Company B's IT manager, "They [customers] normally design the labels for us. That is a main advantage we get. We just print the stickers according to the information they send through the EDI. That information includes item, quantity, where it should go, things like that. They give us information according to their plans. Without EDI we have to develop the sticker here. Then we get more responsibility. With EDI there is a minimum failure rate…".

Without the facility to transmit information directly the stickers would have to be formulated at the manufacturing plant. This could potentially create problems due to inaccuracy of information, such as double entry, wrong specification and wrong location. The Head of ICT at Company D made the following comment: "…Cuts out a lot of human intervention related data errors. In this business especially, getting a digit wrong in an order means a huge difference between hundreds and thousands of dollars. So it's very important to get the data correct".

A significant benefit of new ICT is its ability to share information graphically. The use of images eliminates the need for text explaining details. An image is able to capture data more completely. The use of digital photos has provided a useful benefit for this industry to understand the colour, patterns, size and cut more comprehensively than a descriptive document. It appears that a main problem is inaccurate description or miscommunication of the relevant details. This problem is minimised with the use of digital images where details can be examined through image magnification or colour matching on the computer with the intended colour scheme. The merchandising manager at Company E explained: "…We take a digital photo and send it to them and ask: what do you think? I mean a picture is worth a thousand words. The effort you have to put in to clarify a problem vs. ending up describing the wrong thing, this [e-mail] helps. The information on packing list, cards, and art work, anything, we just send

it through e-mail now".

According to the data, electronic communications provide more accurate data compared to traditional methods such as telephone or fax. The data accuracy is due to directly transmitting data, minimal human intervention and imaging capabilities. The accuracy of data can be partly attributed to the clarity of the data (see next section).

5.2.9 Clarity of information

The standard of legibility of a document produced by new ICT is considerably higher than a handwritten document. All five companies agree that clarity of information is better with new ICT methods. The data suggest that the advantage of using electronic methods is that digital data can be clearly presented in the intended format. It provides the opportunity to format information clearly according to the relevant fields. According to the data, 'clarity of information' helps to reduce the order cycle time because it avoids having to resend information. Before EB, one of the most predominantly used communication tools was the fax. The data suggests several problems with fax. Firstly, the faxes tend to be unclear because of the print or the quality of the paper. Secondly, it takes a longer time to get delivery confirmation, especially if the lines are busy. Thirdly, faxes have a poor reputation for reaching the intended person. There are other reasons, such as high cost and limitation to short documents, which make new ICT such as e-mail considerably more popular than fax. Company A's Commercial manager noted: "…I mean before, sending a fax would take half the day. Then you have to send it again because either it was not clear or it went to the wrong person".

Company B has similar views to Company A. Receiving clear details of images are very useful in this industry because fashion is easier to comprehend through display rather than description. The clarity of information benefits the whole organisation but it is especially beneficial for departments such as procurement for activities such as material sourcing, as the CEO of Procurement at Company B commented: "…compared to communicating with fax, e-mail or EDI gives you much more clarity. We need to see the information clearly in terms of numbers for transactions and images for material sourcing and manufacturing purposes".

The timesaving achieved due to improved clarity is one of the main reasons for

Company C to be in favour of new ICT. Company C's merchandising manager claimed that previously much time was spent on resending information because the information was not clear. Company E also agreed to time savings. According to the data, before e-mail, Company E had to wait about a week to get product details to be couriered. Now, using e-mail, they are able to receive up-to-date product information from their customer.

In terms of data entry to the suppliers' purchasing systems, clarity provides an important benefit. The wrong use of a digit could result in a waste of raw materials. The clarity of the systems enables a more accurate picture of the situation. Outlining this point, the merchandising manager at Company D provides the following comment: "…Here all the specific fields are clearly shown. This is the quantity, this is the price, this is the delivery, and these are the colours. Otherwise when you're doing it, you might miss certain information. They might have to come back again and ask: is it this or is it that? Here it's all specified and if you do not specify, it will not let you go to the next screen or place the order. It will stop you there and say you have not marked this field. That has helped, really helped...".

Overall, the data suggest that clarity of information is far superior with new ICT compared to old ICT. The biggest advantage appears to be time saving due to clear transmission of data the first time.

5.2.10 Quantity of information

The digital revolution has provided the facility to move large quantities of data. According to the interviews at Hong Kong University and EDL this trend is set to continue as mobile devices are fitted with data compression mechanisms. This means that data transfers in the B2B, B2C and C2C segments will increase exponentially in the next five years. Respondents from Companies A, B, C and E state that quantity of information shared with new ICT is more than what they shared before with previous ICT. Here the 'quantity of information' is measured in terms of the size of the message. An image message requires more space than a text message and without the ability to send, receive and store large quantities of information it would not be possible to view graphic information. It appears that, since the new millennium high quantities of data are attached to the main document as supportive or background information. In some

cases, the availability of information is so high that the need for frequent customer contact is less. The commercial manager at Company A explained:

"We don't have much contact with our buyer but there are crucial things that the buyer communicates to me. Say, for example, if a material needs to be cut in a special way or sewn in a particular way, they would inform me after they contact the merchandising guys. Other than that, they contact me to see the progress of their orders. That is about it really. There is so much information on the systems, they have no real need to contact me on a regular basis".

Company E expressed a similar sentiment to Company A, saying that the ability to send attachments has increased the quantity of data available to perform the designated job. Compared to fax, advantages such as user friendliness, visual transmission and speed of delivery make e-mail more favourable. It appears that e-mail provides the opportunity to communicate at a greater depth due to information accessibility. The merchandising manager at Company E commented: "On e-mail, we have more in terms of order details, where they can put attachments, whereas in faxes they wouldn't be bothered. They would just put the summary of it and there would be a lot unsaid. You either do not read between the lines or do not realise what the other person has missed… So I would say in terms of depth of info we get more from e-mail compared to fax …".

The ability to send design and other large files containing information such as fabric specification, cut, stitch and accessories are some reasons why Company B is in favour of new ICT. Observations during the field research identified that some of the products are more technically demanding to manufacture. This is because some items, such as ladies' underwear, require moulding methods or other types of treatment methods during the production cycle. Obtaining this information from the customer directly would create difficulties as it consumes a large amount of the customer's time. By allowing access to the customer's intranet, production information is made available to the manufacturer. The IT manager at Company B illustrated this point: "The biggest advantage is the unlimited space they have to send design and other large data files. Previously only little information was there. Product information, all the technical information, everything is on the intranet. It is easy for us. Previously we got a CD with information. We loaded it to our merchants. CD space is limited, so the information is not enough sometimes and it takes longer that way for production to get instructions

from merchants".

In the case of Company C, new types of ICT have created a new way of conducting business with their UK customer. Before having VMI/CPFR, communication with their UK customer was minimal. Representatives of the customer had to visit Company C in person to deliver the product details and provide instructions. The ability to handle large data files has changed the relationship with their customer for Company C. The planning manager at Company C noted: "New ICT has created opportunity for more effective communication with fewer errors. Before, we did not have any technology as such. M&S, our UK counterpart, informed us in person what needs to be done. There was no direct communication with UK. They used to bring samples to the factory and say, we want 1000 pieces of this and 5000 pieces of that. Today it's a 360 degree turnaround with regard to the communication with UK".

It appears that compared to previous tools such as telephone or fax, new ICT tools such as e-mail or VMI are able to handle a larger quantity of data. The data suggest that the manufacturers use quantity of information exchanged as a way of determining the capability of their ICT tools.

5.2.11 Type of information

Companies A, B and C claim that they are able to share different types of information due to new ICT. Here the different type of information refers to the two categories of audio and visual data. The visual data ranges from video mail, web conferencing, sharing large files such as design files and product specification files such as the BOM. Sharing large files provides benefits such as comprehensive description of the product, background information and graphic information. Section 5.2.10 previously discussed sharing large files. It seems that the high standards demanded by the market have created the need for a detailed specification. According to Company A's commercial manager: "…The type of files my colleagues send to our partners could not have operated with old methods".

In the case of Company B, new ICT has facilitated a more convenient method of assignment delivery. An 'assignment' contains order details and accepting an assignment requires a high level of communication between internal and external parties

in order to coordinate processes such as merchandising, production and primary activities such as logistics. For example, the merchandisers are able to evaluate the physical distribution flow by observing primary and secondary sources. Here a common data source is using e-mail to transfer large data files containing diagrams and other visual data.

The data suggest that visual interactivity is a useful facility provided by new types of ICT. It appears that tools such as video conferencing create faster and more informed decision-making. New ICT seems to provide the convenience of staying in the same place and being able to communicate with the customer thousands of miles away. According to the data, this creates minimal disturbance to the daily routine of both parties. The MD at Company C provided the following illustration: "It's becoming very common now. It used to be much rarer. We are all getting used to it and understanding it better. At my level, I probably have two or three video conferences a week. We do a lot of video conferencing with the MAS group. For example, I had a video conference with Mahesh Amaline, head of MAS group, yesterday for an hour. It works too. He and I wanted to meet. He couldn't be in the office till 9 o'clock in the morning whereas I need to be here at 7.30. So I just said to him, rather than meeting in the office, how about we do a video conference at 9 am? We chatted as if we were in the same room for an hour and off we went".

The data suggest that new types of ICT enable the sharing of information using different types of formats. Video conferencing and sharing of large data files have created several benefits for the apparel industry. It appears that the visual aspect inherent in new types of ICT offers an interactive approach.

5.2.12 Informed decision-making

Respondents at Companies A, B and C believe that they are able to make more informed decisions because of new ICT. This is partly because more information is available. However, the main reason appears to be the high level of information sharing among the relevant parties. For example, a manufacturer making a purchasing decision can seek consultations from other entities in the SC in terms of references, price checks, storage and delivery. Appendix Z2 depicts part of Company A's SC processes according to operations manager. At the first stage, the merchandisers make decisions

about accepting the assignment. Next, the merchandisers communicate product details to the production team. According to the brief, the production team has to make decisions about capacity requirements such as machine hours, storage requirements, and time. There are many other decisions related to logistics regarding physical distribution. The benefit of 'informed decision making' appears to produce a more coordinated SC. It seems that integration between internal and external customers facilitates more informed decision-making. Tertiary sector developments such as internet search engines provide information on a wide range of related issues, which in turn help the decision maker. The commercial manager at Company A noted:

"Well, we have new ICT for internal and external communication systems. In my experience, the integration of different parties has made work cycles faster and more effective. I mean, when I say effective, I'm talking about getting real time information from your internal customers and external customers so you have the chance to make informed decisions…".

In the case of Company B, integration is not to the same level as Company A. However, Company B claims that they have been able to improve the standard of their processes because of better decision making. According to Company B, the availability of information has increased undetected because of the new ICT tools. Company B's CEO Procurement commented: " the current system gives us speed and improves the quality of the processes…everyone takes decisions when there is more information. You don't feel it, but unknowingly people are more informed than those days".

It appears that informed decision-making impacts the manufacturer at different levels. For example, in the case of Company C, reducing raw material waste appears to be an important benefit. The ability to avoid obsolescence by altering production to correspond with the latest fashions appears to have improved Company C's efficiency levels. This is useful because the production floor can cut material according to the latest fashion changes. By avoiding unnecessary production, Company C is able to reduce waste, improve efficiency and focus on in-demand products. As Company C's planning manager commented: "…Because of VMI, if a product is not selling, we inform the production floor before they cut for the next batch".

The data suggest that information sharing facilitated by new types of ICT allows more

informed decision-making. The ability to include different entities in the decision making process has created a more coordinated SC. This is because internal and external customers are able to communicate on a wide range of issues, which creates a platform to make informed decisions.

5.2.13 Better rapport/relationship

A SC is created by combining several entities to deliver a competitive product to the end consumer. The entities involved focus on an individual process such as supplying raw material, procurement, transporting and manufacturing. According to the chosen research strategy, explained in the methodology chapter, this study observes the relationships between the entities from the manufacturer's perspective. The respondents in Companies B and C claim that communicating through new ICT has helped improve relationships within the supply chain. The data suggest that new ICT has enabled a better level of communication, which has resulted in manufacturers experiencing fewer problems. It appears that a variety of problems such as material quality, design issues and production and delivery disputes are resolved faster and more easily because of new ICT. This is because new ICT has the ability to manoeuvre relevant data according to the required format to facilitate informed decisions. The data suggest that there is a correlation between encountering fewer problems and a stronger relationship. It appears that fewer problems create fewer disagreements. Company B claims that they have been able to build a good rapport with customers and suppliers because of new ICT. It appears that Company B accredits faster communications to be a contributing factor. Outlining this point, the Head of ICT at Company B commented: "Before EDI it was all manual. The obvious advantage is better communication. There is a very good 'rapport' between the suppliers and the customers and it is very instant…".

In the case of Company C, they appear to be experiencing fewer mistakes because of new ICT. They claim that joint decision-making, timeliness and informed decision making have enabled them to resolve problems more effectively. It appears that Company C is able to build strong relationships internally and externally because of the integrated technology. Interestingly, both Companies C and B claim that new ICT creates a positive atmosphere. They claim that this is because disagreements do not occur as frequently as before. It appears that Company B is able to avoid disagreements because they are able to avoid problems caused by miscommunication. The

merchandising manager at Company B explained: "…Everyone in the company has access. So when a problem arises, people are aware of it much faster than before. So it gets resolved quicker. That has helped internal relationships and also external relationships with our supplier…A main advantage is the atmosphere new ICT creates in the communication platform between us and the buyer. It [new ICT] hardly makes any mistakes, so there are fewer misunderstandings and errors on both sides".

The data indicated that manufactures are able to build a better rapport with customers and suppliers because of new ICT. Advantages such as informed decision-making, resolving problems jointly, comprehensive data sharing and faster response time appear to be the main contributing reasons.

5.2.14 Staff learning new skills

New ICT in the workplace requires a new set of skills. For example, if a company is using old ICT tools such as telephone or fax, the employees of that company need to have skills such as filing, copying, writing, etc, whereas users of new ICT need to have skills to handle computers and other digital devices. A main requirement for using new ICT is to operate software programs like Excel, Access and Oracle. In the case of Companies A, B and C, training is given to employees on using the relevant ICT tools. For example, the planning manager at Company C indicated that he received at the start extensive training for four months on how to use the VMI/CPFR system. It appears that Companies D and E do not provide a specific training regime.

In the case of Companies A, B and C, in addition to in-house training, staff are regularly sent to learning programmes locally and internationally. It appears that new ICT influences front-end and back-end activities. The data suggest that back-end production staff are learning to be multi-skilled because of new ICT tools such as VMI/CPFR. Company C trains their production staff in a range of skills, because their staff need to change activities according to the information provided by the VMI/CPFR. This means stopping a production line and shifting to another. The data suggest that Company C has implemented new ICT with the intention of using it as a lever for change and to improve their efficiency levels. There is evidence to indicate that Company C has achieved their goal to a certain extent. Outlining this point, the planning manager at Company C made the following comment: "VMI helps us maximise skills as we stop

unnecessary production. The staff are taught a number of skills, as they need to be flexible. Stop one order and shift to the next. So it's like we need flexible staff for VMI and because of VMI our staff is multi-skilled".

The data indicate that, because of new ICT, manufacturers are experiencing a need for training across the plant. It appears that front-end functions at the manufacturer such as merchandising and planning require computer literacy in terms of several software programs. According to the data, because of new ICT tools such as VMI/CPFR, the back-end functions such as cutting and production are sometimes taught to everyone on the production floor. This means that, because of new ICT, the manufacturer attains a multi-skilled, more flexible workforce.

5.2.15 Other positive aspects

The previous sections discussed how new ICT facilitates many benefits for manufacturers. The data suggest that there are other benefits mentioned by the manufacturers. Table 5.1 lists these benefits from point 15 onwards. Lack of data on some of these points suggests that not all manufacturers consider these benefits important. This section lists the other benefits:

I. Global reach/access

The ability to reach individuals in different countries makes new ICT tools, such as the Internet, the most effective communication tools since the invention of the telephone. It appears that this benefit is useful for activities such as procurement and negotiations. This is because merchandisers are able to source accessories and packaging material at a better price.

II. Directly contacting the intended person

The data suggest that Companies B and D have improved communication in terms of reaching the intended person because of new ICT. They claim that the information delivery is important in activities such as negotiations, where security and confidentiality need to be assured. Companies B and D claim that compared to using previous methods, new ICT provides individuals more channels for manoeuvring data,

which makes it easier to reach the correct person.

III. Acknowledgement or confirmation of delivery

The data suggest that conformation of delivery is important because it notifies the transmission of useful information like time of delivery, volume of data delivered, delivery number/address, etc. The respondents claim that it can act as proof to resolve disagreements. It appears that EDI systems use this method to capture order details more comprehensively.

IV. Record of previous communication

It appears that the ability to save previous records provides several benefits. The data indicate that negotiations are more open because of records of previous conversations. The latest developments in the business IT sector indicate that law courts are accepting e-mail and other electronically formatted records as evidence. According to the data, this reduces inappropriate conduct.

V. Traceability

The data suggest that respondents from Companies D and E believe that the traceability of messages is a main advantage of new ICT. They claim that this improves the level of correspondence. It appears that traceability is a low-end capability of EB. In the case of Companies A and C, they have experienced this benefit for a longer period and therefore they do not consider traceability as a new benefit of ICT, as merchandising managers in these companies commented.

VI. Frequency of sharing information

The data suggest that cross-structural communication has improved because of new ICT tools. According to some respondents the number of times they communicate with their customer has gone down. This is because they are able to communicate much more easily, faster and more cheaply now. The data suggest that frequent communications can be useful to maintain a smoother SC.

It appears that companies with high EB capability such as Companies A, B and C mostly refer to benefits 1 to 13 and companies with lesser EB capability such as Companies D and E mention benefits listed from 16 to 21, as listed in Table 5.1. This is because the interviewer asked the respondents what they believe to be the most important benefits they achieve from their ICT systems. The data suggest that in order to achieve benefits listed from 1 to 13 advanced ICT tools such as RTS, FFRA, and VMI/CPFR are essential. It appears that Companies A, B and C do not consider benefits 16 to 21 as important[27]. This means that Table 5.1 divides the benefits as higher end and lower end benefits.

VII. User friendliness

The data suggest that sharing accurate, clear and fast information depends on the ability to operate the tool. Sections 5.2.8 and 5.2.9 outlined the importance of user friendliness in ICT tools for improving the accuracy and clarity of information. It appears that visual media inherent in new ICT provide easier user operability. This is because new ICT is able to act intelligently due to memory chips. For example, error messaging, help centre and options services are available with new ICT tools.

Section Two

5.3 Negative aspects

This section reviews the negative effects from using ICT tools such as EB. The data analysis identified eight reasons why the manufacturers believe EB can create a negative impact. Sections 5.3.1 and 5.3.2 discuss the two most important negative points. Section 5.3.3 outlines the other negatives. Table 5.2 presents the negatives as indicated by the manufacturers. This table summarises problems the manufacturers have experienced or are aware of. It appears that there is a great variation between companies regarding negative aspects. For example, Company B lists only security as negative whereas Company D lists various additional aspects. According to the data, Company D lists the highest number of negatives. Unlike Companies A and C, Company D is able

[27] The exception is Company B as they mention benefit number 17 (direct contact to intended person).

to choose the ICT tools at their discretion. It appears that Companies D and E have studied the suitability of EB for longer than Companies A, B or C. This is because Companies D and E are late adopters.

Table 5.2 Comparing current ICT with previous ICT

Discussed in section	Negatives	*Company A*	*Company B*	*Company C*	*Company D*	*Company E*
5.3.1	Security	√	√	√	√	√
5.3.2	ICT dependency				√	√
5.3.3	Loss of human interaction/Rapport				√	
5.3.3	Wrong estimates			√		
-	High Cost	√				
-	Redundancy					√
-	Touch/feel fabric				√	
-	Reliability				√	

5.3.1 Security

It appears that a main obstacle to popularising ICT tools such as EB is that they are not completely secure, although the security level of network technology has improved with various methods such as digital certificates and encryption[28]. The respondents from all five companies agreed that security is a main concern. It appears that the manufacturers are concerned about financial details. The data from the 'background interviews' suggest that there have been incidences where outsiders entered the systems. However, none of the manufacturers directly admitted that their security systems were breached. The data suggest that as the security improves, more entities would use new ICT tools such as EB. Outlining this point the IT manager at Company A provides the following comment: "…I would say security is a main problem. Still people are a bit hesitant to

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a. Digital certificates – these consist of keys made up of large numbers that are used to identify individuals uniquely.
b. Encryption using digital certificates – (i). Secret key (symmetric) encryption, both parties share key; (ii). Public-key (asymmetric) encryption, both keys must be combined to encrypt and decrypt information.

use business kind of applications on the net, whereas EDI is considered to be more secure".

The data suggest that security issues, including loss of confidentiality, fraud and virus threats, are some of the reasons why manufacturers believe EB creates negative effects. It appears that manufacturers with weaker customer relationships, exposed to less external influence regarding ICT implementation are more aware of the negative points of EB compared to companies with strong customers. This could be because manufacturers without external influence can evaluate their needs more objectively.

5.3.2 ICT dependency

According to the data the purpose of technology is to make functions more efficient, effective and easier to organise. The data suggest that the convenience provided by the new ICT can alter working patterns and behaviour at work and those users can show dependency towards certain systems or software programs. The problem with this is that after becoming accustomed to new ICT, functioning without it appears to be difficult. This suggests that employees depend on certain ICT tools because of particular benefits they provide. The problem with this approach is that if there were a system breakdown the whole operation would come to a halt. The data suggest that in such a situation, employees are less likely to use fax unless there is an emergency. It appears that, during a systems breakdown, employees ignore routine tasks until the system is restored. According to an interview with information communication technology agency (ICTA), keeping fax and telephone may be useful because they can be kept as backup communication tools. The level of dependency is set to develop further as more ICT tools become available. The experts at ICTA further commented that ICT tools are an inherent attribute of this generation. In the case of Company E they claim that one of their sister companies experienced a total stop due to server breakdown. Referring to this incident the IT manager at Company E commented: "... Lihinea clothing is one of our sister companies. They had a breakdown of their SAP server and they were totally lost. They couldn't operate anymore without the SAP server…"

5.3.3 Other negative aspects

The data suggest that there are six other negative points of new ICT, including wrong

estimates and loss of human interaction. The following discussion addresses these two points.

I. Wrong estimates

The data suggest that there is concern about entering the wrong figures into the system. In the case of Companies A, B and C, their system links internal operations like merchandising with procurement and production. This means that when the merchandising manager enters order details into the system, the procurement department is informed how much raw material, accessories, etc to order. The production department receives information about capacity requirements. Therefore, if merchandising makes an error entering order details, there would be waste and inefficiency in many departments. With a manual approach, several employees observe the order details. This means that order details are verified several times. This does not happen with new ICT tools because human interaction is minimised.

II. Loss of human interaction

The data indicate that because of new ICT the level of human interaction is reducing. Here the human interaction is assessed according to level of contact between persons. For example, previously activities such as sourcing were done in person. It appeared that meeting in person provides a better basis to develop a relationship. The data suggest that activities such as negotiations are more effective when each party is able to understand and observe the other party. According to the data, negotiation activities with new ICT can create an impersonal feeling. This means that new ICT could have a negative effect on buyer-supplier relationships.

Companies D and E list the highest number of negatives. This may indicate that other companies have fewer problems with their systems. It is possible that companies D and E list the highest number of negatives because they have yet to implement new ICT. The problems faced by companies D and E are further discussed in Section 7.3.2.

Section Three

5.4 Barriers

This section outlines the barriers to implementing ICT tools such as EB. The data suggest that several barriers prevent manufacturers from using ICT. Sections 5.4.1 and 5.4.2 discuss country infrastructure and remote plant location. Table 5.3 presents the barriers mentioned by the manufacturers. Companies C and D indicate that geographic distance washes away any time advantage gained from using new ICT. This is especially evident where the shipping times are over three weeks. Section 7.2.2 discusses this point in more detail. According to the table, Company D lists most barriers. The data suggest that Company D faced difficulties in terms of changing from old ICT to new ICT. Company D's employees expressed a need for training and guidance. Company E faces a similar experience as Company D in terms of training for employees.

Table 5.3 Barriers to implement ICT

Discussed in section	Barriers	*Company A*	*Company B*	*Company C*	*Company D*	*Company E*
5.4.1	Country infrastructure	√	√			
5.4.2	Remote location of plant	√	√	√		
-	People				√	√
-	Culture/Change issues				√	
-	Geographic distance			√	√	

5.4.1 Country infrastructure

Using Sri Lanka as the research context provided an interesting challenge because of the variations in resource capabilities. It appears that the existing infrastructure in the country has two deficiencies regarding: a) high bandwidth cables, and b) electricity. The background and expert interviews indicate that country infrastructure creates a major barrier for new ICT, although the availability for high bandwidth cables is increasing.

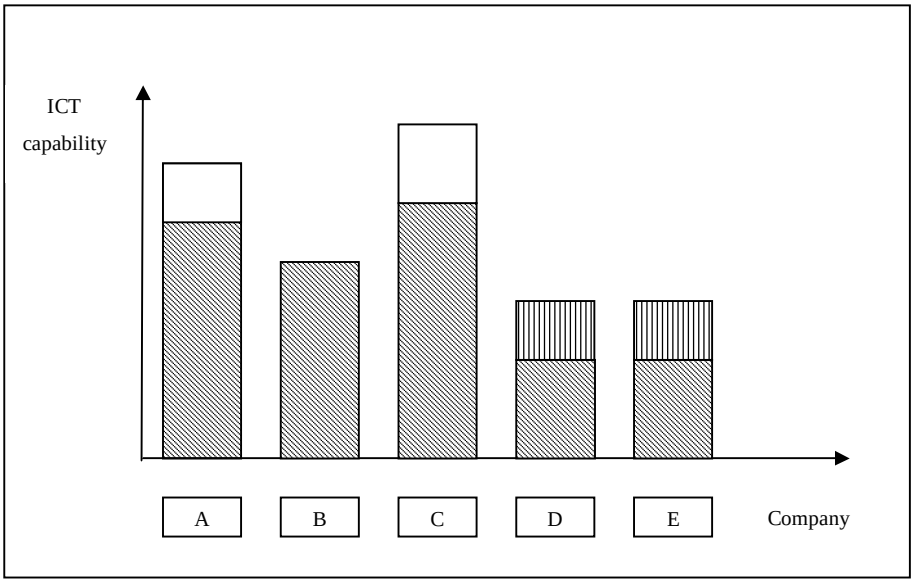
5.4.2 Remote location of plant

Economic activities in Sri Lanka are confined to three major cities[29]. An important component of the apparel industry is cheap labour. Kelegama (2004b) suggests that compared to city labour rates, country villages provide cheaper sources of labour. Because of cheaper labour, pollution and land prices the majority of apparel manufacturers operate outside the cities. The remote location creates a problem for obtaining electricity and optical cables, which are important for large application sharing.

5.5 Summary PC- LF

This chapter discussed internal reasons for implementing ICT at five Sri Lankan garment manufacturers. The first purpose of this chapter was to understand whether there is a deficit between EB capability and usage. The data suggest that companies A and C have more capability than they actually need whilst companies D and E have less than they require. Company B appears to implement an adequate level of technology according to their needs. Section 7.3.2 builds on this discussion. Figure 5.1 below attempts to represent this situation.

Figure 5.1 EB capacity utilisation by the five companies



[29] The three main commercial cities: Colombo, Kandy and Galle.

The height of the rectangles represents the EB capability of the companies. The level of EB used by the companies is identified by the diagonally shaded content. In the case of companies D and E vertical shading represent the additional capability they require.

The data suggested that all manufacturers are in favour of new ICT. The second purpose of this chapter is to group manufacturers according to similar characteristics. The data suggested that there are similarities between Companies A and C, and between D and E. It appears that Company B has characteristics of both groups. This means that Company B takes a middle position between the two groups. The groupings are also reflected in the benefits and negative aspects identified by the companies.

Twenty-one benefits of EB have been identified by the companies. Companies C and A list the most number of benefits. The data suggest that, in order to achieve some benefits, a strong relationship with the customer is necessary. Chapter 6 discusses this issue in more detail. It appears that the number of benefits achieved by the manufacturers has a positive relationship with the level of EB capability. Identifying negatives was a more difficult task. Compared to the number of positives, the number of negatives seems to be low. Section 5.3 discussed the negative aspects of EB. The data identified eight negative points. The answers varied between the manufacturers. All manufacturers agreed that security is one of their main concerns. Company D listed the largest number of negative points, followed by Company E. This suggests that Companies D and E experience more limitations from their systems compared to Companies A, B and C. The data suggest that some aspects act as a deterrent to developing ICT. Barriers like country infrastructure and remote plant location exist because of contextual issues such as growth rate of the economy and country development. The data indicate that these barriers appear moderately significant and would decline as the economy develops.

CHAPTER SIX
ICT IMPLEMENTATION AND INFORMATION SHARING POLICY: PC –LF- RLF

6.1 Introduction

Building on discussions from the previous combination, this chapter presents data in two sections on two attributes both influenced by RLF (role of the lead firm): ICT implementation and access control. The addition of the RLF category provides the opportunity to examine the influence of external parties. Here the lead firm refers to the customer. The data suggest that, in this context, the customer controls the SC in terms of ordering goods, nominating raw material suppliers and managing the transportation of finished goods in the channel. Therefore, including RLF in the discussion provides an understanding of external influences at a greater depth. The first section presents data on the involvement of external entities in the decision-making process for ICT implementation. The second section outlines the 'control' element in the SC in terms of access to the communication network and protecting sensitive information, and examines the current use of an information sharing policy.

The study attempts to reveal the 'role of the lead firm' (RLF) as a management concept inherent (in this type of research context) in modern SCM driven by ICT. Lack of literature on this issue suggested that further research is required to identify underpinning elements. From an analytical perspective, the second combination builds on the findings from the first combination and develops links to the third combination.

The intention is to achieve two objectives. The first objective is to consider the influence of the customer on ICT implementation. Although the customer's core activity is retailing, it appears that the customer also acts as the main authority figure in the SC. This research labels this authority figure as the lead firm. Identifying the lead firm's role will enable researchers to understand SC operations at a greater depth. It is clearly useful to identify whether the lead firm influences the decision to implement ICT at the manufacturer's plant and, if so, the extent to which this happens.

The second objective is to test the robustness of the groups identified previously under

the first combination. The first combination identified that there are three groups among the five companies (i.e. A and C, D and E, and B). The groupings reflect the respective EB capability of the companies.

The following research questions relate to the combination PC-LF-RLF:

Section One:

a. Why do some companies implement new ICT tools to facilitate e-Business?
b. Who influences the decision to migrate to a new ICT system?

Section Two:

c. Who controls the information sharing policy?
d. How can suppliers preserve competitiveness in a total information transparent supply chain?
e. What type of information sharing policy do they use?

The subsequent discussion in the two respective sections provides the answers to these research questions. In the first section, the answers to the 'why' question identified internal and external reasons. The 'why' question (i.e. why do some companies believe e-Business adds value to the organisation?) discussed under the first combination PC-LF revealed the internal reasons for companies to be in favour of implementing ICT. To avoid repetition, only external reasons are discussed in this section. Sections 6.3.1 – 6.3.3 explore the external influences by the customer, sister company and raw material supplier. The data collected from the 'who' question indicate variations in answers between the manufacturers. This is explained in sections 6.3.1 – 6.3.3. It appears that the variation in answers is dependent on the nature of the entities involved in the particular SC, in terms of having single or multiple customers, and the manufacturer's relationship with the customer.

In the second section, the purpose is to understand information coordination of the SC. Answers to the research questions provide further evidence to identify the 'control' element exercised by the lead firm. The 'who' question penetrates the surface to understand the main entity operating in the SC. Sections 6.4.1 – 6.4.2 provide answers

to this question. This question prompted answers about the customer (i.e. lead firm). The 'who' question required a careful approach during the interview process because of the sensitivity of talking about interviewees' customers. Some respondents were reluctant to engage in detailed discussion about their customers and did not appreciate disclosing certain information, which they perceived as potentially damaging if portrayed inconsiderately. The 'how' question collected data to understand the way in which manufacturers protect sensitive information in a totally integrated SC. Section 6.4.3 provides answers to this question. The 'what' question was designed to investigate the current use of an information sharing policy in practice. Recognising specific criteria in an information sharing policy would suggest clear boundaries between SC entities in terms of protecting sensitive information. Section 6.4.4 provides answers to this question.

6.2 Relationship with customer(s) and suppliers

The subsequent discussion in this thesis takes into account the strength of the relationship between the manufacturer and the customer(s). The five companies involved in this research deal with a range of customers located in the USA, United Kingdom and other EU countries. It appears that a manufacturer's view of relationships depends on the number of customers, number of raw material suppliers and the product range. The data suggest that a manufacturer dealing with a single customer has a stronger relationship with that customer than a manufacturer dealing with multiple customers. The question is 'how does the relationship strength impact on the ICT implementation process?' Section 6.3.1 provides a detailed answer to this question.

In this context, the customer nominates the raw material supplier. Therefore, a manufacturer dealing with multiple customers receives a larger number of raw material suppliers than a manufacturer dealing with a single customer. Furthermore, the amount of items in the product range determines the number of raw material suppliers. According to the data, manufacturers working with a single customer and a regular base of raw material suppliers have a better opportunity for achieving an integrated SC compared to companies that deal with multiple customers with a constantly changing raw material supplier base. Additionally, manufacturers that deal with multiple customers tend to experience ad-hoc, short-term relationships and manufacturers that deal with a single customer appear to have longer-term, more established relationships.

In the case of Company A, 96 per cent of their production capacity is dedicated to a single customer based in the USA. Their product range is usually restricted to a single item. This means that Company A continuously deals with the same entities in their SC, containing one customer and a regular base of raw material suppliers.

The situation with Company B is that their customer profile contains five or six relatively regular customers. They have customers in the USA, UK and EU. However, they have yet to establish a long-term relationship with any of their customers. Their product range contains five items. This means they have a higher number of suppliers than Company A. A senior manager at Company B indicated that they aspire to developing a long-term relationship with a couple of their customers. [30]

The situation with Company C is similar to Company A. In terms of production capacity, 98 percent is dedicated to a single customer based in the UK. Their product range is usually confined to two items. This means that their supplier base is not as large as Company B's supplier base.

In the case of Company D, they have little choice but to act as a freelance manufacturer. They deal with six customers based in the USA and the UK. Their product range constantly changes between five to ten items. They have the widest product range out of the five manufacturers and so Company D deals with a higher number of raw material suppliers than the others.

Similarly to Company D, Company E deals with six customers on an irregular basis. They have customers in the USA and the UK. Their product range consists of three items.

The data suggest that the relationship between manufacturer and customer is an important issue when implementing advanced ICT. This is because this type of communication tool allows a higher level of information sharing. Compared to using conventional methods such as telephone or fax, the new ICT tools, such as Intranet or VMI, open the systems at a detailed level, which could display production capacity,

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[30] With one particular customer (i.e. A&F) they have a strong relationship. That customer is allocated 25 percent of their production capacity.

order progress, internal processes, and even employee productivity rates. The data suggest that in such an environment, the manufacturers believe that a strong relationship with the customer is necessary before integrating the communication systems. Section 6.4.3 discusses this in more detail. The data suggest that compatibility of systems and establishing trust are two main problems for achieving integration. Section 6.3.3 provides further details about the compatibility of systems. The issue of trust seems directly related to the length of the relationship. This could be because companies in longer-term relationships have a better chance of understanding the strengths and weaknesses of each other. It appears that Companies D and E frequently face problems in terms of cooperation from other entities in their SC. This could be because they do not have long-term relationships with customers and suppliers. Their suppliers constantly change according to the customer. The data indicate that Company D believes they are unable to achieve integration because of ad hoc relationships. The merchandising manager at Company D believes that information sharing must be based on long-term relationships, with an established level of trust: "Before you think about integration, what you have to build up with your customer and suppliers is trust, and a good relationship. The advantage of having an integrated SC is to have a win-win situation for all…Relationships are very important. It is all interlinked relationships, because the success of one person will depend on the number of people in that link…Also, links should be formed only if those customers and suppliers are reliable to form such a link. First, you should have a good experience with them. Without it you cannot just go and have an integrated relationship with a new one [entity]…you do not know about them. They do not know about you. You cannot build a relationship just over a month or in one dealing. Dealing through experience, you should know whether it is reliable to have integration".

It appears that Companies A and C do not face problems in terms of receiving cooperation from other entities in their SC. These two companies are less concerned about relationships and trust compared to Company D and Company E. The data suggest that this is because Companies A and C have already established trust with their main customer whom they have serviced for a long period. Considering that the customer controls the whole SC, a strong relationship with that customer helps to maintain trust with other entities in that SC. Section 6.4.1 explores this issue of the customer controlling the SC.

Section One

6.3 ICT Implementation

There are several considerations involved in making any capital investment decision. Perhaps technology implementation as a capital investment warrants special attention because of reasons such as the obsolescent nature of ICT due to its rapid advancement, staff training requirements, relative high cost and the need for restructuring processes to suit the new systems. This research underlines several important elements involved with the decision making process for implementing ICT. The following sections undertake discussions on two of these elements in terms of external influence and access control.

Observations during the interviews led to the conclusion that Companies A and C are more IT literate and desirous of implementing advanced ICT, such as SAP, compared to the other manufacturers. This research has identified three possible reasons why companies favour implementing new technology. Firstly, they have realised the improvements in their functions from the new ICT they already have (see section 6.2). They are encouraged to implement more technology after seeing the benefits. Secondly, an influential second party has advised them. Their dependence on the customer for orders leaves them little choice but to implement the proposed technology. Thirdly, they were misinformed by the hyperbole fed by the IT providers.

According to the data, there are several reasons for migrating to a new system. It appears that migration occurs because of internal and external reasons. In terms of internal reasons, all companies provided similar answers regarding 'why' they implement such technology.

This section goes beyond the PC-LF combination to answer the 'why' question in greater depth and to identify who else is involved in the decision to implement ICT. This means exploring whether manufacturers implement ICT on their own initiative, or they act according to the requirement of an external party such as a customer. The analysis suggests that manufacturers operating with one customer, in a long-term relationship, with fewer products tend to be more likely to comply with that customer's request. In contrast, in a situation where companies have multiple customers with ad

hoc relationships and a wide product range, the companies appear to be less committed to implementing a particular technology as instructed by the customer.

6.3.1 External influence

This section attempts to indicate the level of influence exerted by the customer on the manufacturer to employ a specific type of technology and the commitment shown by the manufacturer to serve the customer according to the level of dependence on that customer. To understand external influence comprehensively a detailed review of contextual issues, such as the relationship between the customer (retailer) and the manufacturer and the product range, appeared useful. In line with this requirement, this research conducted a thorough review of the partnerships and the relevant product ranges.

The idea for exploring external influence in greater depth came from an insight during the interview process. Several of the core interviews indicated that some companies implement technology with a capability level greater than they require. An interview with a SAP expert provided the opportunity to explore this claim in more detail. This SAP expert was in charge of implementing ERP systems at other manufacturers in various sectors in Sri Lanka. The SAP expert claims that Companies A and C do not require an advanced system such as SAP to run their operations. According to this expert, SAP contains more capacity than required by any garment manufacturer in Sri Lanka. This expert mentioned that the levels of applications in this context are too limited to justify such an investment. Section 7.2.2 discusses this point in more detail. The data analysis identified that Companies A and C have more capability than they actually need to function. For example, in the case of Company A, they have the capability to link with other entities (in addition to the customer) in their SC although this does not appear to be possible at present due to compatibility issues. This means that Company A is unable to achieve the full potential from the ICT tools they have implemented. In the case of Company C, they have the capability to disintermediate and reduce the length of their SC. However, they are not able to take advantage of this capability because their SC operates according to the decisions of their customer. Companies A, B and C admit to implementing technology as advised by the customer rather than on their own initiative. Statements made by the IT manager at Company A and the IT manager at Company C provide evidence to this claim:

"…On the application side also, for example, the EDI application is something that the customer proposed…If they [customer] tell us to use a system, we definitely follow on that path. But there hadn't been major requests that we couldn't cope with in the past" (IT manager, Company A).

"The VMI of course was initiated by the UK customer [M&S]. Basically, when you're working with M&S, when they put in a system you're supposed to support it, not ask questions. Maybe our parent company Sara Lee Courtalds had some input but no direct input from us…" (IT manager, Company C).

The situation in the case of Companies A and C is that over 95 per cent of their production capacity is dedicated to one customer. As a result, they have little or no choice but to accept the customer's choice. However, the data suggest that there are clear advantages for Companies A and C from being in this position. One of the main advantages is to have a stable SC in terms of regular customers and suppliers. This consequently facilitates a reliable communication platform. Furthermore, Companies B, D and E would prefer to be in a similar position to Companies A and C. This is because Companies B, D and E aspire to cater for one customer's needs rather than for several. The main reason for Companies B, D and E to take this view is that they face problems due to systems incompatibility (see also Section 6.3.3). A statement by a senior manager at Company B, the CEO Procurement, outlines the compatibility problems they face: "What we find is each customer is coming out with their own package. Whatever you say, I think, at the end of the day we have to satisfy the customer. Sometimes they [customers] come with a good system, sometimes they come with a wrong system. Still we cannot say we cannot do that because that is the customer. If they want their status reports in a particular way, we start giving our reports that way to them...".

During the inquiry, some interviewees were reluctant to admit their submissiveness regarding implementing ICT according to their customer's wishes. Initially most interviewees attempted to suggest that ICT implementation happened purely at their own discretion. Interview questions like 'why did you specifically implement this brand of technology?' and 'how did you find out about it?' and 'who else in the SC is using it?' prompted answers from the interviewees revealing that in most cases it was the customer who suggested the technology in the first place. The answers starting with the

line 'to be honest…, as long as this is confidential…, and well actually…' indicated that the interviewees were providing more accurate answers the second time around.

6.3.2 Benchmarking

In this research context, the participant companies operate as SBUs (strategic business units) for their respective groups. Considering the close association within the group, it was important to understand the benchmarking practices followed by respondents. For example, Companies A and E belong to the same group, so they share management practices. Inside sources revealed that benchmarking in the group has created some level of competition within the group to have better technology than fellow SBUs. This led to the question: how do manufacturers practise benchmarking? Do some companies implement technology without an appropriate level of understanding about the capability and functionality of a particular communication tool? It was important to find answers to these questions because if manufacturers are implementing technology as a marketing tool without appropriate assessment, it could lead to unjustified costs and unnecessary capability. Answering these questions, the IT manager at Company A stated that they do not follow others in the group unless the technology is tried out at others first and it would be clearly beneficial for them:

"I wouldn't say at MAS as a group [Company A belongs to MAS] if one factory implements something, unless someone sees the business benefits, they won't join the same bandwagon. It is quite evident even in the SAP system as well as the RTS system. People want to see the benefits before they join in. So that has been the case not just because it's the new thing. Each company wants to ensure that whatever investment they are making is justified".

This means that most manufacturers in the group do follow benchmarking practices but they appear to take care in terms of choosing the appropriate technology. The only other company to mention benchmarking was Company B. In the case of Company B, benchmarking practices are conducted according to external sources such as raw material suppliers.

6.3.3 Compatibility of systems

Only companies B, D and E raised the issue of 'compatibility of systems'. It appears that companies A and C do not face this problem because their customer base is consistent and confined to one large customer. The other three companies (i.e. B, D and E) face difficulties in terms of frequent changes to the technology. The CEO Procurement of Company B indicates that they have to deal with constant changes to their ICT infrastructure: "Implementing new ICT has become a fashion-like thing. It is a very difficult thing to cope with. Today a customer asks for one type of system, tomorrow another type. It's something we find difficult to cope with. There has to be some sort of uniformity".

As a solution to this problem, Company B believes that what is required is an uploading facility, as a hybrid of all systems. A main issue faced by Companies B, D and E after they implement a specific technology according to the customer's wishes, is how long will that customer stay with them. It appears that before implementing advanced ICT systems long-term relationships need to be established.

Accordingly, Company B's CEO Procurement commented: "...It looks like they [new customers] are having their packages and they are now asking us to input data into that. So ideally, what we should have is an uploading facility from ours to them. In the next stage, we will do that…We are developing relationships, so we think they [customers] will stay with us. What we are doing is trying to have a hybrid best of all the systems like a common platform so everyone can use it...If you are working with them ['NEXT' as a customer] you have no choice but to have the system they say".

It appears that a significant barrier to implementing ICT is the coordination within the SC. A requirement of network technology is that connecting systems have to be compatible. If a manufacturer implements a type of technology aspiring to link with suppliers, will those suppliers in return implement technology that is compatible with the manufacturer's technology? At the moment, the answer to this question is 'no' because the manufacturers are relatively small players and they do not have the power to get others to co-operate. The data suggest that there is no coordination in terms of ICT implementation. The need for a central authority to coordinate the implementation process seems to be important. This means that a central authority such as a lead firm

should provide guidance in terms of instructions or pre-selected criteria (agreed by all parties) to create a common communication platform to ensure compatibility in that SC. The MD at company D discussed lack of direction for implementing appropriate technology:

"We need to move out of the tailoring mentality. But the reason that I do not see us able to get much benefit out of e-Business is because of the size. If I'm buying, let's say, for US$100,000 or 200,000 from a supplier who is having a turnover of US$100m how much clout [influence] do I have with him, that I can get him to get in to EB to do SCM with me? So in that context it is very difficult...unless the suppliers themselves have some EB systems and we are able to link in, there is no point. For us to be able to go and push that kind of supplier, not yet. We as a company do not have that influence. It would be a benefit if you can get everyone to come on board and do that. The thing is how do you get those people to do that when you are a small player in the whole business?".

The data suggest that this makes a stronger case for a central authority to act as a mediator to ensure all the entities in a particular SC implement compatible technology. The MD at company D believes that the customer would not be interested in playing the mediator as that would be additional work for the customer. It appears that Company D considers it impossible to develop relationships without the involvement of a central authority in the SC. Furthermore, the data suggest that ICT systems at Company D become obsolete faster than ICT systems at Companies A and C. This suggests that companies operating in an established SC can use their technology longer.

Section Two

6.4 Access control

The previous section identified that the manufacturer's decision to implement technology is subject to influence from the customer. The data suggest that the customer stipulates the technology with the intention of achieving integration with the manufacturer's processes. It appears that the integration between the customer and the manufacturer provides a better level of control for the customer. Therefore, it is useful

to understand how the customer controls the SC prior to exploring other issues regarding information sharing in the SC. The discussion in this section is based on three issues: who is involved, how information is protected, what type of safeguards they have to guarantee protection. Building on the insights from the previous section, the concept of the lead firm is explored further in order to understand what constitutes a lead firm. Does it have to be a single customer SC? Can ad-hoc supply chains have a lead firm? Section 6.4.1 provides answers to these questions.

After examining SC control, this section undertakes discussion on three areas. Firstly, the situation regarding information flow between the manufacturer and the customer is considered. Here, the level of access to the manufacturer's information, which is open to the customer, is investigated. The data suggest that there is a positive link between the manufacturer's dependence on the customer and the level of information available to that customer. Observations during the interviews indicated that Companies A and C provide their customers with a higher level of access to their network compared to the other three companies. This is because Companies A and C have a stronger dependence on their customer base than Companies B, D and E.

The second area of discussion examines the consequences of having a transparent information system. The literature suggests that one of the main advantages of having an advanced ICT tool such as e-Business is that it facilitates transparency between systems. However, considering the competitive nature inherent in a business environment, allowing access to sensitive information may suggest imprudence. This issue needs careful consideration to identify whether the nature of the industry has an effect on transparency.

The third area of discussion explores how information is protected by an information sharing policy. The literature review contains a large volume of research on information sharing. However, it did not identify an information sharing policy to protect sensitive information in a transparent environment. The literature suggests that at best only an assumed level of agreement is practised in terms of sharing information.

6.4.1 Control of the SC

The purpose of this section is to outline the entities involved in controlling the SC. It is

useful to understand whether these SCs (i.e. research context) practise a collective approach (e.g. union) or a central approach (e.g. lead firm) in managing the SC. A collective approach requires all entities to share management responsibility. The literature identifies benefit sharing and risk sharing as key features in a collective approach (Lysons and Gillingham, 2003). A central approach suggests management of the SC by a single key player. There appears to be a lack of literature discussing a central authority managing the SC.

According to the data, several customers (i.e. retailers) assume the role of a central authority. This concept of a central authority seems to occur in SCs where the manufacturer dedicates most of his production capacity to serve the customer. In the case of Companies A and C, over 95 percent of their production capacity is dedicated to one customer. In this case, the level of dependence on that customer allows a natural level of control for the customer. The data, moreover, suggest that Companies A and C's SCs achieve a better level of performance in terms of internal customer satisfaction compared to Companies B, D and E. The data also indicate that leadership is an assumed role taken by the customer and there is no explicit statement to define the customer as the lead firm. This means that the customer usually exercises authority when it is beneficial for him. For example, Companies D and E mention that if a supplier nominated by the customer makes an error in supplying goods to the manufacturer, the customer has the discretion to ignore that problem. This leaves the manufacturer without clear instructions as to what action should be taken.

At this point, the analysis focuses on why the customer would want a particular type of technology at the manufacturer's plant. According to the planning manager at Company C, a main advantage for the customer is that he can achieve efficient management and better control of the processes: "The VMI system was implemented under instructions by M&S. The main advantage for M&S from VMI is 'convenient management'. They can keep an eye on their products in terms of stock availability, distribution status, so they can source for suppliers in advance".

The MD at Company D outlines how the customer controls the whole SC in terms of ordering the products and nominating the suppliers, and the manufacturer's role is confined to manufacturing. Although they are able to source suppliers, they work with nominated suppliers:

"Sourcing for suppliers on the Internet is very minimal, hardly any. Say we want to call ourselves 'garment or apparel exporters'…we are basically tailoring shops. Our customers tell us what they want, what designs they want, when they want, where to buy the raw material, what prices to buy, what quantities to buy, and everything. You are sort of a guy who is bringing all that information and making a product out of it. So you can call it whatever you want. The word the Indians use is 'aggregator'. You aggregate the fabric from somebody, trims from somebody, the buttons, the labels, the thread and everything else, take the information and put it in to a product, sell it to the customer for a fixed price when the customer wants it. So, in other words, we have very little control of our SC. We are just providing the labour function…".

According to the merchandising manager at Company E, the customer controls the SC in terms of nominating suppliers; however, there is no agreement on responsibility. Company E's merchandising manager commented: "To some extent the customer influences the buying process. That is one of the drawbacks we have because at the purchase of raw materials we find that we don't have that level of clout [influence] with the supplier because the supplier goes and sells their products directly to the customer at the development stage. So most of the clout is with the customer. See, it works both ways. Most of the time if we need anything we go to the customer and the customer influences the supplier to push it through. So, in a way, you can say the customer controls the SC but what happens is, if there are any cancellations, the raw material suppliers make a royal mess of themselves, the customer will happily say, you buy the fabric, you pay for it and you sort out the liabilities. There is no agreed control as such where the customer says, look, I nominate the supplier. If the supplier causes any delays, I will make sure things go right. There's nothing like that but in terms of influence it's the customer who influences the entire SC".

In this situation, the customer operates as the controlling entity or the lead firm. However, it appears that there is no clear agreement defining the level of responsibility between the suppliers, manufacturer and customer. The data suggest that a main function of the controlling entity is to facilitate coordination between the other entities. In the case of Companies A and C, the customer (lead firm) provides this function whereas Companies B, D and E do not receive clear guidance from their customers. For example, Company C's SC enjoys a better level of communication due to fewer errors. The data suggest that this is partly because of the coordination practised by the

customer. In the case of Company A, they are confident about the level of efficiency maintained in their SC. Company A's merchandising manager explained: "…I think in purchasing we are well ahead of the competition. That's feedback we got from our suppliers because our response time is much faster, accuracy of our information is far better and also the way we deal with supplier relations is also quite different because we treat our suppliers the same way we treat our customers because they are equally important to the business. So I think our communication is far ahead of our competitors".

Companies D and E provide a different view of dealings with their suppliers. It appears that these two companies constantly face problems because of miscommunication with their suppliers.

6.4.2 Access to customer

The term 'access' describes the authorisation to enter another entity's communication system. For example, the customer receives a level of access to the manufacturer's communication system. This section discusses the issue of access further, to establish how the customer gains a better level of control due to 'visibility' by implementing advanced ICT. The data suggest that there is a link between the level of access given to the customer by the manufacturer and the strength of their relationship. It appears that a stronger relationship with the manufacturer enables a higher level of access for the customer. The customers of Companies A and C receive greater access compared to the level of access received by the customers of Companies B and D. This is because A and C depend totally on a single customer whereas B, D and E have multiple customers. Therefore, the level of dependency or obligation is less for Companies B, D and E. The planning manager at Company C explained why their systems are open to the customer: "…We have a pretty open system. We depend on them [customer] a lot. It's the same for everyone [manufacturers]. Without them [customers] we don't have orders".

In some instances, it appears that the manufacturer prefers to give as much information as possible to the customer. This was only evident in Companies A, C and E. It was a surprise to see Company E's willingness to show the customer as much information as possible. In the case of Company E they do not have long-term, established relationships like Companies A and C. The analysis found that Company E's openness

was because Companies A and E belong to the same management group and that they have common management practices. In contrast, Companies B and D believe that the more information that is open to the customer, the more problems they would have to face.

Outlining the benefits of the VMI system, the planning manager at Company C indicated that the customer achieves a better level of control because a higher level of access is given: "The biggest benefit [of new ICT] I suppose is that we never had a direct link with the customer. With this 'collaborator' [VMI], we can declare our production flow to the customer. So based on that information he [customer] can call and expedite certain orders and so on. Basically the customer has access to production information here. This gives better control for our customer".

This means that some companies believe that providing access is important, whilst others believe providing access causes more problems. The difference of opinion may be understandable because in the case of Companies B and D, they serve multiple customers and therefore, divulging too much information could create additional work as well as reveal which customers are prioritised.

The data suggest that the customer prefers an open system at their manufacturer's plant. This is because the customer can then control the information flow in the SC to provide each entity with the relevant information they need. In the case of Company C's SC, the customer initiates the order cycle and assumes control to coordinate the SC for activities such as informing the suppliers about how much raw material they need to produce, delivery dates for transportation and preparing storage facilities. It appears that the customer in Company C's SC assumes the lead firm's role. A similar position is practised by Company A's customer in terms of coordination. The data suggest that SCs with a clear lead firm face fewer communication errors compared to SCs with an ambiguous authority (see also Section 6.4.1).

In the case of Company B, access for the customer is restricted to the manufacturer's production planning stage. Unlike Companies A and C, Company B is not totally dependent on a single customer; therefore they have the discretion as to what they want to share. The group head of ICT at Company B believes that when more information is visible the customer will become more demanding: "At the planning stage we allow

them [customers] to see in terms of the cost sheet, material make and so on, but not at the production stage. At this moment we do not allow them that facility…It [access] is a decision we have to make. Whether we are going to allow them in to the system. No sooner you show them everything, they are going to get really demanding. Maybe delivery is tomorrow but still we are in the cutting stage. But we are going to work maybe around the clock. So these are very critical issues. We need to decide what to show…".

The CEO of procurement at Company B indicates that giving too much information is a way to attract trouble. He believes that in a situation where the customer is happy with the current level of information, it may be better not to provide additional information other than what he [customer] requests: "We have not given lot of access to them [customers] yet, but we intend to give access. Integration is not a problem at the moment. Sometimes if you give extra information you're asking for trouble. So we can always give access. Here it is on our Intranet but we are reluctant at the moment because they are not asking either".

In the case of Company D, the level of visibility for the customer is scheduled to improve with the new ICT they plan to implement. This new technology is an e-tracking system. This will allow the customer to see each stage of the product life cycle from order initiation to delivery.

Outlining this new facility at Company D, the Head of IT said, "…In terms of e-tracking, customers can log on to our system and track their orders online, which will be launched on the 7th of May. They will be able to see how much they have ordered, how much is being delivered, how much is in cutting, how much is packing, how much is finished goods, all that they will be able to track…We are able to provide that information online. Immediately it is available on the web so that when people log in, as at that time they [customers] will be able to see what the exact tracking is. What we have within our system is a VPN, our WAN is a VPN. In terms of tracking data they [customers] will have to come through the Internet to our website logging as themselves…They have a specific password. We will do it with GAP, Nike, Colombia, and M&S. Web track will be a vital part. I think they [customers] will be very selective. You have to gear up with such systems. I don't know who's doing it in Sri Lanka but a lot of them will fall in line".

According to the MD of Company E, customers are requesting more access from the manufacturers. The data suggest that access will be a main criterion when selecting a manufacturer. This means that in order to get business, the manufacturer must implement advanced ICT to facilitate access for the customer. This issue is not just confined to giving access. The manufacturer will need to achieve some level of integration (in terms of compatibility) to facilitate access. Therefore, to provide access, the manufacturer needs to implement technology that is compatible with the customer.

Company E was recently told by a customer to be more transparent. Previously seconds (overproduction) were sold in the local market. Now the customer is requesting visibility of the seconds. Company E has little choice but to respond to the customer's requests, as retaining customers is important for their survival. The IT manager at company E explained that customers are getting more demanding in terms of access: "…I think with the current situation you have to be open. You can't hide things. You have to be open to do good business, so I don't see any negative thing from information sharing. Now recently there were some inquires from GAP. They wanted to see what we are doing with the seconds. How many pieces are left? Whether they could do something with the seconds? Now in future we are going to have a system so that they will be able to see online how many seconds are left in Company E and other factories".

6.4.3 Preserving competitive advantage

So far, the data indicate that Companies A and C have opened their systems to their customers. In the case of Company B, they are reluctant to open their systems because they do not have regular relationships in the SC. This suggests that Company B is perhaps more concerned about preserving sensitive information. However, the data suggest that this is not the case. Company B's decision not to share a higher level of information is based on the fear of creating more problems for themselves rather than being concerned about protecting sensitive information. This issue was identified when the CEO of procurement at Company B stated that information in this context is not so secretive or sensitive because the price structures are fixed. He further added that compared to other industries, like automobiles or computers, this product is 'low-tech' and therefore the dangers from the information falling in to the wrong hands would be minimal. At the level at which the fieldwork companies operate, the competition comes only from foreign manufacturers.

According to Company B's CEO Procurement: "Even if the information falls in to the wrong hands, what can they do? Everyone is talking about information, information, but this is not top secret like making a computer. The area we are doing, we do not have competition in Sri Lanka. Our competitors are in Hong Kong. So at that level I don't know what the supplier can go and tell another manufacturer. In terms of the customer, it is a partnership, so we tell them our capacity anyway. They do not want to give us 100 percent of their products and we do not want to give them 100 percent of our capacity. There is that kind of understanding".

The merchandising manager at company D has a similar comment to the CEO of Company B. She believes that it is unlikely that a supplier will divulge information to another manufacturer because it will affect his business in the end. Comments from the general manager at company E suggest that there is not much to preserve in terms of confidential information in this industry as prices are standard or known by other parties. It appears that competitive advantage in this industry is based on delivery on time and reliability of order completion. Therefore, information sharing does not pose a threat to protecting sensitive data. The general manager suggests that integration would not create problems for preserving competitive advantage; rather it will improve the whole process by opening up the channels.

6.4.4 Information sharing policy

The literature review did not find any empirical research regarding the issue of information sharing policy. The data suggest that these companies are not using such a policy at present but, in general they agree it is an important area, which will need addressing once their systems are up to a particular standard. The planning manager at Company C agreed that an information sharing policy is essential before exercising integration. Commenting about the practicality of a totally integrated system, he said: "A totally integrated SC is realistic. But when you're sharing info you need to have your controls, you need to have a good policy on how you are going to share…".

The MD at Company C suggested a different view, that in their situation an information sharing policy may not be as important as in some other cases because they work with the customer as one entity. In this scenario, clear boundaries may not be required as the relationship is already clearly defined.

Regarding information sharing policy, Company C's MD explained: "There is no information sharing policy as such. The IT team here report directly to IT in the UK. So although they report to me on plant operational issues, they report directly to the UK. If you take the organisational structure they only have a dotted line to me. They have a much stronger line to their counterparts in the UK. In that context, the IT team here is part of the IT team there. Therefore, whatever can be shared between them, our UK business or the other international businesses, there are no barriers. It's open skies. On that the guys communicate all the time…".

It appears that because Companies A and C have a closer link with their customer and suppliers, the need for an information sharing policy is less. It is different for Companies B, D and E because their customers constantly change. Having an information sharing policy would provide security for practising a higher level of integration.

6.5 Summary of PC-LF-RLF

The second combination structured the discussion on two of the attributes involved in the TAC framework, ICT implementation and access control. Including the RLF in the discussion provided insights into the influence from external entities. An overview of the SC relationships between the customer, manufacturer and the supplier revealed that a manufacturer dealing with a single customer has a stronger relationship with that customer, compared to a manufacturer dealing with multiple customers. The data indicated that manufacturers working with a single customer and a regular base of raw material suppliers have a better opportunity of achieving an integrated SC compared to companies that deal with multiple customers with a constantly changing raw material supplier base. In terms of ICT implementation, the manufacturer is influenced by external entities such as the customer, raw material suppliers and sister companies. A major problem for implementing ICT is the incompatibility of systems. A common problem faced by Companies B, D and E is that they must regularly change their ICT tools according to the customer. This is because they do not have long-term customers like Companies A and C.

The discussion explored how the customer controls the entire SC but there is no agreed level of responsibility. Therefore, the customer has the discretion to become involved

when it is beneficial for him. Similarly to ICT implementation, access to systems also depended on the relationship between the manufacturer and the customer. Companies A and C have completely opened their systems to the customer, whereas Company B has restricted the information flow to the customer according to their discretion. Company B prefers to provide just the required amount of information because they believe that providing too much information can create additional problems. It appears that, in this industry, competitive advantage comes from delivery of goods on time and order completion. Therefore, transparency in the SC is unlikely to create problems for preserving competitive advantage. Most of the companies believe that transparency would open the channels and improve the speed of response. None of the manufacturers currently uses an information sharing policy. Discussions indicated that such a policy would be particularly useful for manufacturers working with multiple customers.

CHAPTER SEVEN
E-BUSINESS CAPABILITY: PC – LF – RLF – AE

7.1 Introduction

Chapters 5 and 6 identified the benefits and problems of EB and the influence from external parties on implementing ICT. This chapter outlines the use of EB in three sections: current status, evaluation and expectations. The acronym AE represents 'appropriateness of expectations'. As a category, AE examines the realistic possibility of achieving certain benefits from EB. This part of the thesis provides answers to the following three research questions in three sections.

Section One:

a. How do current e-Business users position themselves in terms of usage?

Section Two:

b. What criteria can be used to evaluate an ICT tool?

Section Three:

c. Why do companies have high expectations of e-Business?

The first section assesses the extent to which the manufacturers currently use EB. This provides an EB capability spectrum upon which to base the discussion. The intention is to include the insights gained from the first combination (PC-LF) about the capability of the systems (see Table 5.1), add the findings from the second combination (PC-LF-RLF) about relationship strength, and finally include the manufacturer's own assessment about their ICT usage and provide a 'snap shot' to assess the impact of e-Business on SCM. For example, Companies A and C are at the higher end of the EB capability spectrum, whereas Companies D and E are at the lower end. Achieving a benefit such as 'visibility' would only be applicable to manufacturers at the higher end of the spectrum. This means that on an issue such as 'visibility,' Company A is able to provide evidence from practice whereas Company D could only make anecdotal claims.

Next, the research attempts to understand the manufacturers' perceptions about the ICT

systems they use. The discussion includes the manufacturers' own evaluation of their systems. It is useful to appreciate the evaluation criteria because there is a lack of understanding about the assessment of an existing ICT tool or when purchasing a new ICT tool. This section identifies three specific selection criteria currently used by some manufacturers. The discussion in the second section reveals that, so far, intangible aspects such as motivation and morale are not included in the evaluation criteria list.

The third section provides a discussion of the hyperbole created mainly by IT solution providers. The purpose is to achieve a clearer understanding about the limitations of EB in order to determine its suitability for a company and industry. The data suggest that the apparel industry is an ideal recipient to enjoy the benefits of EB because it does not operate with sensitive information.

Section One

7.2 Current status

This section examines the current use of EB at the manufacturer. The purpose of this section is to find answers to the research question 'How do current e-Business users position themselves in terms of usage?' The answer to this question is presented in three inter-related headings. Firstly, the five manufacturers are positioned according to their level of EB usage. The positioning is undertaken according to the manufacturer's own assessment, to avoid researcher bias and misinterpretation. Next, the accuracy of their positioning is tested by reviewing their ICT functionality. To perform this task, the investigation uses one of the benefits facilitated by EB, visibility. This enables an appreciation of the extent to which the manufacturers achieve this benefit. Finally, a review of the positioning identifies areas of the manufacturers' ICT that require further improvement.

The discussion under the first heading categorises the companies according to the level of EB usage and relationship with the customer. The relationship strength is included in the assessment because the data suggest that there is a direct link between ICT implementation and relationship with the customer. Section 7.2.1 explains this point in detail. The purpose behind amalgamating these dimensions is to construct a

comprehensive image, in a comprehensible format, which provides contextual detail and data analysis (see Figure 7.1). The contextual data in Figure 7.1 refers to relationship influences and data analysis refers to the EB levels. This image will provide a 'snap shot' of the companies.

The second heading links to the discussion undertaken in the first combination, PC-LF. The first combination identified several benefits achieved from using ICT. The discussion outlined that, in this context, 'visibility' is the most important benefit. The term 'visibility' is used interchangeably with 'transparency'. The insights gained from the histogram (mentioned under the first heading) are used in the second heading to analyse the 'visibility' aspect in more detail. The purpose is to identify the current levels of visibility achieved by the manufacturers.

The third heading outlines the limitations of the ICT systems currently used by the manufacturers. This is undertaken to determine whether there is a link between the ICT limitations and the EB levels. For example, the study indicates that the manufacturers at the bottom of the spectrum are facing considerably more problems compared to manufacturers at the higher end of the spectrum.

7.2.1 Level of EB

The discussion under PC–LF identified a number of positive outcomes achieved by participant companies, reflecting the level of functionality of their systems. This section extends the findings from the first combination to understand the gap between capability and functionality. The manufacturer's own assessment of their company's EB level provides an overview of the current position of ICT usage. Table 5.1, listing the benefits of EB, provides the necessary verification to test the accuracy of the positioning of the fieldwork companies. For example, if a manufacturer claims to be at the higher end of the spectrum, the number of advantages he mentions should be in line with his positioning. This is because the ICT capability depends on the type of technology used by companies. For example, the capacity of the main server will determine the speed of processing applications and the amount of data that can be processed. The details of ICT capability tend to be technically oriented and difficult to explain in isolation. Technical details are not included in this thesis because a discussion of these aspects is outside the scope of this research.

The discussion under PC-LF-RLF identified the need for a long-term, established relationship and a narrow product range for implementing advanced ICT. This suggests that manufacturers with stronger relationships will have a higher level of EB. Section 6.2 indicated that Company C has the strongest relationship with the customer whilst Company E has the weakest relationship. The relationship strength from high to low among the manufacturers is C, A, B, D and E. This is identified according to the amount of production capacity allocated to a particular customer or several customers. According to this assessment, the level of EB among the participant manufacturers, in descending order, should also be C, A, B, D and E. This is depicted by Figure 7.1.

The data suggest that manufacturers in the same group are also in a similar position in their EB usage. At this point, it is useful to recollect the information provided on the groups because understanding the groups provides a better insight about the accuracy of the EB levels among the manufacturers. The grouping has been developed since the beginning of Chapter 5. The grouping was based on 'EB capability' and the 'relationship with the customer'. The main purpose of the groups is to use them for comparison purposes. The discussion in Chapter 6 compared the groups and by doing so reinforced their validity.

At this point, the manufacturers' statements need reviewing to understand the EB level they use. In the case of Company A, based on the comments made by the merchandising managers, they use a medium to high level of EB to upload and download information to and from the customer. They implemented technology according to the customer's requirements. The uploading benefit essentially refers to data entry in terms of purchase orders and downloads in terms of sending invoices. This enables them to reduce the order processing time and avoid human error related mistakes (see Section 5.2.4).

According to the above discussion, Company A is practising a medium to high level of EB. In contrast, Company D is at the early stages of implementing EB. Most of their processes still operate with conventional methods. For example, in Company D they have to enter the order details manually into their system, which is vulnerable to mistakes. Additionally, they have to wait until the shipment arrives to see what goods they have received. Unlike Company A, a customer did not guide Company D to implement technology. The head of ICT in Company D explains how they want to improve their systems and overcome this problem:

"We have started doing EB. Right now we are doing it the conventional way. Now what happens is when suppliers send rolls of fabric, they send the information with that. So we have to enter that data in to our ERP system… What we plan to do in the future is provide our warehouse (e.g. in Hong Kong) with scanners so information will electronically flow into our ERP system, which cuts out all the mistakes made in data entry. Now what happens is we have to wait until the shipping note comes in order to identify whether the correct goods have come. Here we will have that information well before, the moment the bar codes are put in. Before they ship the stuff we will know the data of what goods are coming in. So we can prepare with our factories…".

It appears that Company D is still in the planning stage for practising EB. Providing an assessment of their EB usage, the Head of IT claims that his company deserves the third place out of the five companies. Outlining his company's technology position the Head of IT at Company D claimed that his company would be a close third behind Company A and B.

However, according to the data, Company D takes fourth position behind Companies C, A and B. Figure 7.1 depicts the EB levels using a histogram. The data suggest that Company D's current EB usage is limited to only few EDI applications. Several statements indicate that Company D does some level of EDI with two of their customers.

In terms of turnover, Company D is the smallest in the sample group. The strategy of Company D is to have a cost focus. Therefore implementing costly technology is undertaken only when no other alternative is available. Expressing this point the MD at Company D commented: "In terms of EB we do a bit of EDI, that is, with GAP and Nike, focusing on the SC from the customer's point of view. Otherwise hardly. Communicating is based on e-mail. We ourselves are trying to do something to improve communication…".

In terms of relationships with the customers, Company D is in a similar situation to Companies B and E. The Head of IT at Company D commented that they are unable to realise the true potential of EB until they have developed strong relationships with few of their customers and narrow the supplier base. Section 6.3.3 discussed the difficulty of achieving compatibility due to frequent change of suppliers.

According to the Head of IT at Company D, "You need to have a solid infrastructure to conduct EB… We have not truly realised the full potential of EB. It has been quite slow... If you are doing EB with a supplier, you have got to have them participating in the same concept, otherwise you will not be able to do that. I would say we are still a few years away from realising the true potential of EB because it has been slow to be taken up with the suppliers…".

In the case of Company E, they do not have the necessary infrastructure to conduct EB applications. Similarly to Company D, Company E is focusing on building the necessary infrastructure now. They are still trying to connect the internal processes before attempting to integrate with external parties, as the IT manager at Company E explained: "We are not doing EB because firstly we didn't have proper ERP. Now of course we know where our data is…Now we are in the stage of improving our resources to that level, so our next stage is to develop that area. Basically, what I'm saying is without internal integration there is no point having EB. We are getting the infrastructure…".

In the case of Company B, a recent merger has shifted attention to having a technology focus. There is some evidence to suggest that during a short period they have implemented the latest technology. It appears that they have skipped several stages of technology developments to arrive at the current position. Recently they have completed building the necessary infrastructure to conduct EB applications. Although they have the infrastructure, finding the right partner is important. The problem for Company B is that they do not have a single partnership like A and C. As noted in section 6.3.3 Company B has to keep changing the systems according to different customers. The Company B Group Head of ICT said, "EB, we have only started doing it properly. Presently we are only doing the EDI with customers such as A&F where all the communication with the customer is through that".

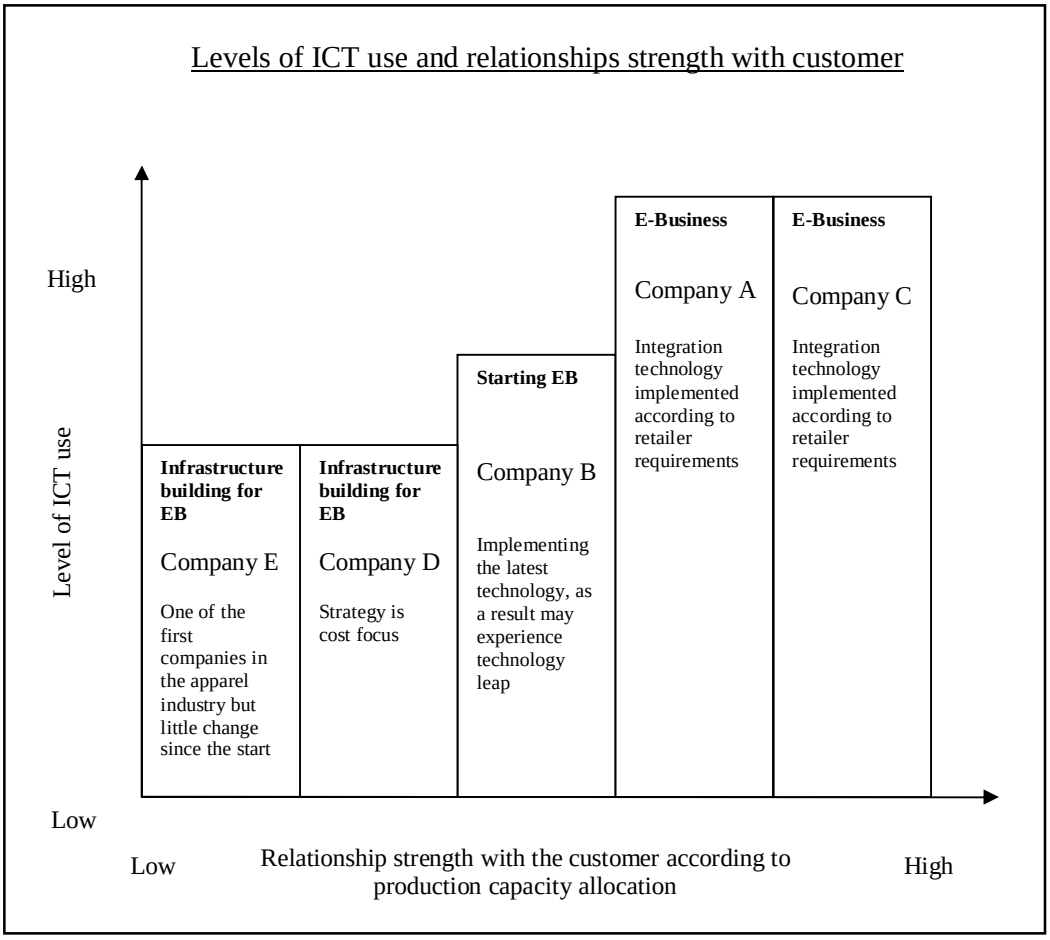
In the case of Company C, it appears that they practise the highest level of EB. Their VMI/CPFR system enables them to practise a high level of EB with their customer. According to Company C's IT manager, "We use EB quite a lot. We are in the process of linking SAP with VMI Collaborator. The information will be passed from VMI to SAP and the system will be updated automatically and frequently. That is going to be the future, automating of the information flow. Total supply chain management step by

step. So initially, you will get your core SAP system implemented and then get it linked with VMI Collaborator and various other external information systems. Step by step we are moving towards total SCM electronically".

Figure 7.1 shows that Companies C, A and B have a higher level of EB utilisation than Companies D and E. The left axis in the diagram represents the level of EB use and the bottom axis represents the relationship strength with the customer. It is interesting to observe that the level of EB use has a direct correlation with the strength of relationship with the customer(s). It appears that strength of the relationship determines the compatibility of technology. This means that collaborative relationships improve compatibility[31] and consequently enhance integration. Figure 5.1, previously indicated that the number of benefits achieved from using EB is higher when the relationship with the customer is stronger. This suggests that relationship with the customer is the most important aspect for conducting EB. It appears that the strength of the relationship with a customer depends on the level of dependence on that customer. Therefore, strong relationships may lead to unutilised EB capacity because the customer is able to exert influence for implementing a particular type of technology. For example, in the case of Companies C and A there is more compatibility with the customer but their dependence on the customer is also higher than B, D and E. Therefore, Companies C and A are more likely to implement technology according to customer demands. However, Companies C and A have unutilised EB capacity (see Figure 5.1). In contrast, Companies D and E have a weak relationship with customers (see Figure 7.1). Consequently, Companies D and E have inadequate EB capacity (see Figure 5.1) because they are not in any committed relationships. Therefore, it is difficult for them to achieve compatibility. Company B seems to have found the right balance between retaining relationships and gaining compatibility. It appears that Company B has an adequate level of EB capacity according to their usage. This is because they are able to maintain independence whilst sustaining commitment in customer relationships.

[31] Implement ICT with criteria as agreed by both parties to ensure compatibility between the systems

Figure 7.1 EB spectrum



The ICT levels at the companies are as follows:

Companies D and E make very limited use of EDI with few suppliers and mainly use traditional technology such as faxes and telephone with some Internet access for e-mail. These companies are classified as not doing EB. However, they are building the infrastructure to facilitate EB.

Company B holds the necessary infrastructure for EB. It is starting to use EB, with a new initiative to compete on technology. It shows willingness to adopt new technology for SC integration.

Companies A and C have a medium to high level of EB use and are aspiring to SC integration.

The data suggest that the fieldwork companies can be grouped in to three groups

according to EB capability and level of partnerships. For example, Companies A and C form the first group with the highest level of EB, Company B is in the second group with a medium to high level of EB, and Companies D and E form the third group with a minimal to low level of EB. It appears that due to the strong partnerships, the customers of Companies A and C influence the ICT implementation decisions. In terms of Companies D and E, no customer is pushing them in to implementing ICT.

The justification for the EB positioning of each company can be supported using Table 5.1. In Table 5.1, the number of positives listed by the respondents in alphabetical order amount to 12, 9, 14, 9, and 7 respectively. The data suggest that Companies C and A achieve the highest and B, D and E indicate that they get less from their systems. The data suggest that Companies A and C have more visibility than the rest due to their advanced EB capability. This indicates a direct connection between the level of EB usage and the number of positives achieved (see Table 5.1).

7.2.2 Visibility

This research identifies 'visibility' as the main benefit of EB rather than speed. In this research context, speed is not the main benefit because of the geographical distance between the manufacturer and the customer. All participating companies recognise faster cycle time as an important benefit of EB. From a micro perspective, EB helps to reduce the waiting time between processes and speeds up the communication process. From a macro perspective, considering the overall lead time, advanced ICT does not make a significant difference. It appears that in the current context, a more useful benefit would be to see another entity's data in order to facilitate the smooth operation of processes such as procurement, packaging, shipping and storage. The planning manager at Company C explained that a more frequently updated system would not serve a real purpose: "A more frequently updated system I don't think will make any difference, because that time is anyway spent at other departments like packaging or shipping. So it will not serve any real purpose. For example, if the shipping time is four weeks, it will not make a difference by updating the system any quicker than two weeks. Once the system is updated, the shipment is going to be at sea for another two weeks".

It appears that the effectiveness of fast communication is slowed by long shipping

times. Therefore, considering the circumstances, speed may not be the most important benefit of EB. In the case of Company A, visibility is high due to the integration between their processes and their partners. The commercial manager at Company A described the relationship between technology and business competitiveness: "The integration has created visibility for us to see what's going on with our partners... I mean it's a two way thing. I would say the business requirements have increased because of better technology capability but also more capability has made the business more competitive".

In the case of Company B, they achieve a medium to high level of visibility with their customers in terms of stocks in stores and warehouses. Company B does not have limitations in their systems in terms of visibility. Company B is, however, unable to achieve the same level of visibility as Companies A and C due to the lack of strong relationships with customers. The IT manager at company B explains what they can see from their systems: "….Production uploads the information every step of the process so everyone can see what the status is on a particular order and take decisions if they need to. Then we have an EDI system to link us with customers so we can see product details, technical details and things like that…The EDI is with some customers like GAP, A&F and VS. From the EDI we can see stocks in their stores and warehouse. Everything we need to know comes through the EDI...".

In order to achieve better transparency, a higher level of integration is required. In Company B's situation of serving several customers, establishing visibility is a systematic process. The CEO of procurement at Company B explains that integrating the SC with a customer (e.g. A&F) is a gradual process and they are still at the initial stages: "We are starting to do e-Business. At the moment they [A&F] are only taking shipping information from us. Everything is scanned. Stuff goes into the (software) package and then it gets shipped out. I think gradually they will introduce the whole integration thing…".

The visibility at Company C was previously outlined by comments made by the planning manager (see Section 5.2.1). Out of the five companies it appears that Company C is able to achieve the highest level of visibility. This is due to several reasons. They have a strong relationship with a single customer, who demands a response in goods replenishment according to their [customer's] sales levels. This

provides real-time information for Company C as to how many items have been sold on the shop floor. On the other side, Company C's customer undertakes close monitoring of the production plant. Therefore, a high level of visibility is open to the customer. Secondly, Company C can consistently improve their integration without disruption. This is because, unlike Companies B, D and E, Company C does not have to make changes to their ICT according to different customers.

In the case of Company D, they achieve a considerably lower level of visibility compared to Companies A and C. The MD at Company D admits to having difficulties due to limited availability of information when it is required. This suggests that Company D struggles with internal integration as well as external integration. As the MD at Company D explained: "… We are trying to revamp the whole SC. So information availability is less than 30% - 40% at a time when you need it. You can probably find it by digging around or asking half a dozen people".

Most processes used by Company D lack connectivity to external parties such as customers or suppliers. Because of this, they are not able to achieve visibility. The operations manager at Company D provides an explanation regarding this point: "Tools-wise fax most of the time and e-mail. E-mail we use every day. Whenever there is an issue, we have to contact the customer. Then we do ERP for purchasing but not to the extent of informing them. ERP is not connected. It is not an extranet. Right now ERP is an Intranet facility within our group. It's not been connected to supplier or customer".

In the case of Company E, they admit to having difficulties with customers because of poor visibility of information. One reason for this situation is that they have not had many requests in the past to implement EB infrastructure. They have realised that in order to survive in a competitive market they need to have visibility, especially after the end of MFA. The IT manager at Company E explained their current visibility status:

"…For EDI of course we don't use the Internet much, because we do not have enough applications. We are not very transparent to the buyers and suppliers at the moment…In terms of our current system I think we can improve a lot. We have to improve the communication, we have to be more transparent. Because with the challenge we are going to be facing beyond 2005, we need to have an edge over competition, like be more transparent to the buyer...Some time back the garment industry was not very

competitive. Very few garment manufacturers... If you take the current situation, if you have lack of communication or lack of skills or something, you can't survive in the market".

The General Manager at Company E expressed a similar sentiment. He believes that what is required is for the customer to be able to see the production capacity at the manufacturer so the customer can make decisions that are more informed. He believes that they are unable to do that because the internal processes are not up to standard.

As Company E's General Manager explained: "…As for external communication with our customers we do not have a direct online system where they can log in and check up capacity and availability, things like that…We have to make our processes work before we can ask our external partners to be more transparent and link to our system. We have to make sure our systems are updated to a level where we can link in to their systems…transparency has a huge impact on the business. But I think we need to prepare ourselves and that's why we are lacking right now... Once that's in place then we need to open our channels out to the customer who needs to see our capacity and be able to make their decisions where they have to and that would cut out a chunk of time from the whole SC".

The data presented so far under 'current status' suggests that in terms of technology capability there are two groups, Companies A and C as the top group and Companies D and E as the bottom group. Company B appears to have some characteristics of the top group because they have the necessary infrastructure to conduct EB, but they can relate to the bottom group in terms of being unable to achieve integration due to having multiple customers.

Companies A, B and C do not indicate limitations in their systems. The planning manager at Company C mentioned that he has no reservations about the capability of his system and he is very satisfied with the level of information available. He commented that his system provides visibility of what is in the pipeline and in transit because of bar coding.

According to the data, only Companies D and E commented on the limitations of their current systems. Companies D and E position themselves behind A, B and C. The

limitations faced by these two companies will be discussed next.

7.2.3 Limitations of current systems

This section reviews the ICT used by companies in order to understand the limitations of their systems and address areas that they feel need further improvement. The data suggest that Companies A, B and C are satisfied with the current flow of information provided by their systems. In the case of Companies D and E, there is evidence to indicate that their level of communication is not considered up to standard and they constantly experience communication breakdowns due to systems inadequacies.

It appears that there is a correlation between the levels of communication and the capability of the systems. From high to low, the communication level appears to be in correlation with the EB spectrum depicted in Figure 7.1. The comments made by respondents seem to suggest that companies A, B and C are satisfied with their information flow and even admit to having the capability to generate more information than they actually need. For example, the logistics arrangement between Company C and its customer is FOB (freight on board), which means that once the shipment leaves the manufacturer's harbour the responsibility for the goods belongs to the retailer (in this case M&S). The planning manager at Company C comments that their systems are capable of tracking products until they reach the customer even though this is not a necessary action.

This comment indicates that some companies implement systems with capabilities greater than they require. In contrast to the position of Company C, Companies D and E are at the lower end of the spectrum. Companies D and E are still in the process of infrastructure building to facilitate internal integration. These two companies complain about the information flow available to them at a functional level. The general manager at Company E commented that before they open the channels for external integration they have first to ensure internal integration. Similarly to the position of Company E, Company D suffers from lack of integration between internal departments. The merchandising manager at Company D lists a catalogue of inadequacies regarding their ICT systems at an operational level:

"There is no proper flow of info, even between departments. There should be a flow of

info from merchandising to procurement. Sometimes complete info is not passed to us…The ERP system that we have is not very user friendly, training is needed to enter info in to that system. It gets a bit complicated… Some computers do not have the capacity to run the particular system. It might go slow, it might get stuck somewhere and you have to restart the whole thing. I would say ICT becomes a headache after that…".

In the case of Company B, they have a Time Access Calendar, which informs interested parties of each stage of production. In a similar position to Company B, Companies C and A have an advanced ERP (e.g. SAP) system to inform the customer of their work in progress. Due to the high level of information available from Companies A, B and C the need to communicate on a regular basis with the customer is far less, compared to D and E. In a similar situation to Company D, Company E admits to having major communication breakdowns with customers. Due to poor information flow, they have previously lost several of their important customers. This suggests that Companies D and E are more vulnerable to miscommunication with the customer. A comment by the merchandising manager at Company E explains this problem: "Bad cases of miscommunication here would be plenty where more often than not it happens. For example, today I have a problem where a customer is extremely unhappy because we have short shipped and we did not advise them on time and they had not accommodated for the short shipment…we were running around trying to catch up… it slipped through the cracks to inform them, look, we are shipping only 85 per cent of the order. As a result instead of having goods for 803 stores they only have goods for 700 stores, and they don't have anything to put in the balance of the stores. So apart from loss of planned sales where the customer's planned revenue is lost, we haven't even given them time to see if they can pull forward units from other styles to be able to fill that floor space…".

The data suggest that because of the communication problems, Companies D and E have to operate through field offices and buying offices. This creates additional echelons in the SC, which reduce their profit margins. The customers set up field offices to ensure upstream processes run smoothly in terms of order completion by manufacturers and maintain an adequate level of communication. Third-party buying offices act as the middle person between the factory and the customer to facilitate downstream processes because companies such as D and E are unable to communicate

to a required standard. In theory, eliminating both these additional echelons is possible by improving the information flow to the customer. The merchandising manager at Company E admits that the reason customers use field offices and third-party buying offices are due to poor communications. As the Company E, Merchandising manager explained: "…Not every factory has a good level of communication with the customer where the clarity of information is concerned… If a customer feels the need to have a field office, either we have not convinced them of our competency or we are not servicing the customer the way we are supposed to service the customer…If the Sri Lankan factories improve their communication, increase the level of visibility like in terms of order status…we could reduce the dependence of them [customer] using buying offices".

The discussion so far presented the current situation regarding ICT usage at the five manufacturers. The data suggest that there are ICT capability differences between the manufacturers according to the level of EB they use, with Companies A and C at the higher end and Companies D and E at the lower end of the spectrum. Company B appears to be in the middle position between the other two groups. The next section evaluates the functionality of the ICT systems in order to understand whether the manufacturers are using the technology to its full potential.

Section Two

7.3 Evaluation

So far, the research process has identified that the fieldwork companies have different levels of ICT capability. It further illustrated that the involvement of a prominent partner in the form of a lead firm influences the decision to implement advanced technology. This part of the chapter examines the criteria manufacturers currently use to evaluate their ICT systems. The purpose of this section is to find answers to the research question 'What criteria can be used to evaluate an ICT tool?' The focus is to identify evaluation criteria and subsequently investigate the limitations of those criteria. The data suggest that ICT has improved motivation in the workforce and there is evidence to suggest there are improvements in efficiency levels. Although the increase in motivation is accredited to implementing new ICT, motivation is not used as a criterion

when evaluating ICT.

It is interesting to see whether manufacturers with higher levels of EB capability conduct more evaluations compared to manufacturers with lower capability. Similarly, it would be useful to identify if users with lesser EB capability relate their problems to having lower EB capability levels. The data suggest that there are several issues such as systems inadequacies, lack of understanding and change faced by the companies at the lower end of the EB capability spectrum.

This section will also include statements by the manufacturers evaluating each other's systems. For example, Company D comments on Company C's system. This method provides the opportunity to achieve some level of cross-referencing because the data can be verified through another source.

7.3.1 Evaluation criteria

Authors such as Auramo *et al* (2003), Power and Simon (2004), Croom (2005) and Silveira and Cagliano (2006) suggested that further research is required to understand 'how companies evaluate their ICT systems' Collecting data to answer this question was difficult as interviewees were clearly unprepared to provide a straightforward reply. This could be because they have had this technology for a relatively short period. All participants believe that systems constantly measure themselves in terms of capability from a functionality perspective. For example, if a particular system is unable to send or receive a type of data due to non-connectivity, incompatibility or incapacity, the requirement would be identified from a reactive approach. It appears that there are times when companies assess proactively according to pre-selected requirements such as considering the number of applications forecasted to be transmitted against their current systems capacity. A structured evaluation would provide understanding of the current system so it would be possible to compare it with products available in the market. Table 7.1 lists the evaluation criteria mentioned by the companies.

Table 7.1 ICT evaluation criteria

Company	Evaluation criteria	Comments
A	cost, customisation and technology	In addition to these criteria they identify immeasurable criteria such as changes to morale and motivation of the employees
B	cost, reliability and compatibility	Internal assessment for compatibility and capacity reviewed by IT committees
C	cost, customisation and technology	Their customer influences the type of technology more than the rest. They share management practices with Company A.
D	cost, connectivity and capacity	They believe that most importantly cost has to be right to implement a particular technology.
E	cost and technology	They are currently testing products in the market. The results indicate time saving and managing data.

Examining products in the market for evaluation purposes happened at Company A when they implemented the real-time system (RTS). The IT manager at Company A indicated that they examined the products available in the market prior to implementing technology: "…The real time system we went for, we did a proper evaluation, I mean we considered the manual operation,…we took stock of it, then we looked at the products available in the market and then we came to a conclusion that we'll go with one particular solution and that was implemented".

Observing the available products in the market may provide a useful evaluation base but it requires specific criteria to structure the evaluation process. The data suggest that evaluation criteria are also used as selection criteria when choosing new types of ICT. An inquiry regarding selection criteria with Company A's IT manager revealed that cost, in-house development/customisation and technology are the three most important selection criteria for them. Company A's IT manager revealed that the implementation cost was one third of the product cost. The systems they use are customised by their own technology team to suit their requirements. Software such as SAP technology is scaled down to deal with smaller volumes of production.

According to some interviewees, the difficulty of evaluating an ICT system is that it ignores some important intangible benefits such as motivation. For example, an ICT tool such as RTS (real time system) can indicate employees' production rates, efficiency and earnings. The data suggest that this system boosts the employees' morale when the

employees see their productivity rates and their earnings. It appears that this RTS technology motivates the employees to work harder. The interviewee claims that this situation is unquantifiable and therefore does not get an adequate level of attention. It appears that an evaluation of an ICT system needs to consider the wider impact it creates to achieve a more accurate evaluation. For example, the IT manager at Company A claimed that it is not always possible to quantify return on investment: "Sometimes certain things are very qualitative. You can't quantify those things. For example, say worker motivation. When they see their efficiency online they get self-motivated for doing something more. They also get to see their current earnings. That (the motivation they get) is something you can't quantify…".

In the case of Company B, they conduct evaluation using internal and external sources. For Company B, a main method of external evaluation is benchmarking against their competitors. In addition to benchmarking, Company B relies on views from suppliers to maintain and update their systems. Internally, Company B conducts assessment starting from the bottom to the top, then vice versa. Internally, they also conduct regular IT committee meetings to understand the current situation. The CEO of procurement explained the evaluation activities at Company B: "To evaluate our ICT system we regularly keep on benchmarking in Sri Lanka and outside. The group is very open for any suggestions. Even at the board level they are very IT savvy... Also we open up and ask new vendors to give solutions on the IT side. We have IT committee once a month, we look at requirements in the system that come through the bottom, then top down, again with board members and see what is happening. We also have relationships with established suppliers. They regularly inform us of what is on the market…".

In the case of Company E, they claim to have undertaken a comprehensive investigation as to the suitability of implementing advanced ERP systems at their plant. According to the general manager at Company E, the results are overwhelmingly in favour of introducing the new system. The general manager at Company E explained:

"…we looked at the cost, we looked at the benefits that could come out of it…For example, how much time do we go about collecting data to make a 'direction sheet'. It takes for ever. This is a sales sheet...Now the info to put this thing together because we are not yet SAP driven takes two weeks just to get this document out, whereas, if we had SAP to replace this system it is a matter of picking up the sheet. So here is a classic

example of two weeks management time cost when we could have been talking to a customer selling more products, so the opportunity cost of not having this is huge. So yes to answer your question, we will always look at the cost angle and the benefits are beginning to come. It's a positive response".

Other employees at Company E made similar comments regarding their expectations on achieving convenience facilitated by new types of ICT they are about to implement. Section 6.3.1 previously explained that according to a SAP expert, manufacturers operating at this scale do not need an advanced technology system such as SAP because the level of applications is limited. However, in this case it appears that convenient management is a reason for implementing SAP even though that technology may not be used to its full potential.

7.3.2 Evaluation of systems

The previous section discussed the evaluation criteria used by manufacturers when implementing a new ICT system or suitability of the existing system. In this section, the discussion on evaluation is extended further to consider the functionality of the systems. The discussion presents manufacturers' comments on other manufacturers' ICT systems. These comments provide a useful means of cross-checking the data from an external source.

The data so far suggests that Companies A and C have greater capability and a higher level of EB applications. However, it is emerging that some of this capability is not being used as Companies A and C's systems contain more capability than they actually require. A main reason for underutilisation of systems is due to the role played by the lead firm. The lead firm nominates suppliers. Therefore actual sourcing of raw materials is not necessary. The IT manager at Company C explains this point: "Most of our suppliers are nominated by the customer [lead firm]. There is no major requirement to source suppliers. The need to have some sort of electronic interface with our suppliers is less. There is no major requirement as such. Although we have that capability, it is not a need to have but a nice to have...".

This quotation clearly illustrates that Company C has more technology capability then it needs. Unlike Companies A, B and C, Companies D and E do not appear to be keen on

new ICT. Companies D and E claim that there are more important things to consider before prioritising EB as a fundamental requirement. Companies D and E claim that what they need is better training so people can operate the existing systems more effectively. The merchandising manager at Company D commented: "New ICT has helped. But there are more important issues to deal with… Systems are forced on people. If I come to Company D, I should know how to use that particular system, otherwise, I will not be able to process anything…".

It appears that Company D is facing resistance to change from its employees. In terms of the organisational culture it appears that unlike the Companies A and C, Company D is not keen to change its ICT systems.

Companies A and E belong to the same group although in terms of technology capability they are at the opposite ends of the spectrum. Company E believes that even though they do not have EB capability, they do not lack any functional capability. According to the IT manager at Company E, "We are not lacking anything because we don't have EB. Up to now, we have not had any issues due to lack of technology. I would say we have been able to perform on the same level without having all the EB like Company A".

In the case of Company B, they are not totally dependent on a single customer. So unlike Companies A and C, Company B is not pushed by a customer to implement technology. In addition, unlike Companies D and E, Company B does not resist new ICT. It appears that Company B has a strong focus on new types of ICT including EB. Therefore, Company B's views can be perceived as more impartial compared to the other two groups (i.e. A and C influenced by the customer, D and E reluctant to change). Company B exercises its own initiative with a strong ICT focus. Company B's CEO Procurement commented: "We have looked at SAP but it's not applicable to us. The guys who have got it will never say it's bad. But we can't really see how the parameters apply to this industry. Half the guys will pull out an EXCEL spreadsheet from whatever system they have. SAP is not something that can be justified. We have an in house ERP system and we plan to link it to the web-based system but I don't think at this scale Sri Lankan garment companies need SAP".

It appears that the comments made by the SAP expert are verified by the comments

made by the CEO of procurement at Company B. This may suggest that Companies A and C are incurring a technology investment cost they cannot justify. Extending his argument further, the CEO of procurement at Company B commented that connectivity with other members in the SC (e.g. with freight forwarders) would be required only when Sri Lanka is operating on a LDP (Landed Duty Paid) system. This suggests that having technology that has the capacity to facilitate connectivity at that level is not necessary. Company B's CEO procurement explained: "In terms of logistics Sri Lanka is not yet on a LDP (Landed Duty Paid) system, we are doing FOB (Freight on Board), some people doing CM (Cut and Make). Our next step is to go to a LDP system. That is where the connectivity will have to come…".

The data also suggest that ICT tools at Company D are not user friendly. It appears that employees face constant problems with operating the systems. Company D's cost focus means that employees have to work with traditional systems until they are replaced. Company D's merchandising manager explained: "Processing times of purchasing orders on systems take a longer time. When I was in Readyware I was part of a team implementing an ERP system. It was so simple [at Readyware]. You just have to enter the order details. All the purchasing orders were ready. Handling info was so easy, so user friendly. Even amending it was so easy. Screens were so user friendly. Whatever I requested, they were able to give me reports, PO (purchase order) duration and everything was like there within minutes. It was so good. Comparatively when I see our system here, it is very slow…".

The discussion under the second section outlined the evaluation criteria used by manufacturers when they implement a new system or when they evaluate an existing system for its suitability. The data suggest cost, customisation and technology as three important considerations. The evaluation of the systems revealed that Companies A and C are using systems with capabilities they do not actually need. The data also indicated that Companies D and E's technology is not very user friendly. However, there is evidence to suggest that employees at Companies D and E are showing signs of resistance to change.

Apart from the customer's influence it appears that Companies A and C have an organisational culture that is keen to implement new technology. In this case, it is useful to understand the contribution made by hyperbole created by commercial IT providers.

The general manager at Company D's Hong Kong branch indicated that there is a large amount of hyperbole disseminated by IT solution providers. The following statement is indicative of the general manager's comments: "There are obvious advantages…. but sometimes I feel that the capability of the Internet is exaggerated by different companies for commercial purposes. I went to a conference here in Hong Kong with my MD a couple of months ago. One of the presentations was about how crucial e-Business is for product quality, motivation, reliability and so on. I mean something like e-Business may influence operations indirectly but these things are subject to human interaction. Our industry is still labour intensive. We are not in such a position to automate processes and use various automated systems that can assess the inventory of raw materials for example. That kind of thing may be applicable to something like the automobile industry".

Authors such as Quayle (2002) and Cagliano *et al* (2005) suggest that the main reason for the existence of hyperbole is lack of understanding about the true capability of EB. In an attempt to explore the existence of hyperbole, the next section outlines some of the expectations for EB held by the manufacturers.

Section Three

7.4 Expectations

The Information Age has introduced many communication devices that make information sharing easier than ever before. A main obstacle for understanding these technologies is the rapid advancement of the tools and the fast adoption rate expected from the consumers. For example, Microsoft recently announced that they are ending the support for 70 million users of Windows 98. This was originally due to end in 2003 but was extended following customer protests (BBC 07/11/2006). From the IT industry perspective, the focus is on developing new devices rather than exploring the potential of existing products. The discussion in this section attempts to clear some of the ambiguity surrounding the expectations from EB. The purpose is to answer the research question 'Why do companies have high expectations of EB?' Newspaper surveys indicate that the majority of ICT users are unaware of the technical details or how to use the tool to its full potential (Financial Times 2005). This suggests that a better standard

of knowledge about the true capability of EB is required.

Aggressive advertising entices users to adopt new technology based on connectivity between the systems. For example, a manufacturer implementing this technology has to ensure that his SC partners use the same type of technology. If all the parties in a SC implement compatible technology, the SC would have achieved platform integration. The battle among the IT solution providers such as IBM, Microsoft and Cisco is to capture the largest market share. Aggressive advertising has led to ambiguity regarding the true capabilities of network technology. The limitations of this technology were slow to be realised because, up to now, mostly large organisations used this technology. The existing high performance levels in those companies camouflage any significant problems created by ICT.

The heavy advertising, limited technical knowledge and lack of empirical evidence have encouraged anecdotal benefits to create high expectations of EB. The data suggest that some manufacturers expect to achieve unattainable benefits such as an automated SC. There are two reasons why an automated SC would not be realistic in the context of the garment industry. The biggest problem would be the scale of operations. Experts (interviews) such as the Assistant Commissioner of the Export Development Board (EDB) and Rapier Consulting believe that the volumes currently produced by the Sri Lankan apparel manufacturers are too small to justify having an automated system. In addition, considering that this industry is labour intensive, implementing an automated SC may not deliver the desired competitive edge. However, it appears that some manufacturers are in pursuit of technological excellence even though it may not be a suitable option. The data suggest that in the case of Companies A and C, regular exposure to technology exhibitions and conferences are organised by the customer. This may explain why Companies A and C are more desirous of the latest technology. Company A's Commercial manager commented that in order to compete on a global scale, automated SC would be necessary: "…As integration goes, a totally integrated supply chain would be the goal. We can only assume the business needs of tomorrow but if you take the current trend as an indication, we'll need to have an automated supply chain in the future if we are to compete at a global scale".

It appears that Companies A and C are enthusiastic about ICT to a stage where they wish to keep up with the latest trends rather than identifying what technology is most

suitable for their operations. The existence of such an environment is partly created by the customer who encourages the manufacturer to implement the latest technology so he (customer) can practise a higher degree of control. It appears that Companies A and C are determined to continue using EB with the intention of achieving competitive advantage. The IT manager at Company A expressed his comments regarding integration from EB: "To gain competitive advantages you have to do integration with suppliers and customers. Otherwise, you will not gain the necessary competitive advantages over your competition. So if you need the integration, the only available path is e-Business unless you have lease lines with all your suppliers and customers, which is not practical. It will be too costly. So that's the way forward but it also involves a lot of cost, even developing web applications. Maintaining it is not easy".

It appears that anecdotal benefits exist because of the enthusiasm shown by some manufacturers. On the other side, anecdotal problems appear to act as a safety net for manufacturers who are reluctant to change their ICT. Company D indicates that they are aware of the hyperbole surrounding ICT. The data suggest that the level of enthusiasm about EB at Company D is not as high as in Companies A and C. This lack of enthusiasm may be caused by anecdotal problems about new types of ICT. The research identified several anecdotal problems. Protecting sensitive information was a major issue. The data suggest that in this context the sensitivity of information is less, compared to other industries like automobiles or computers. Therefore, facilitating integration would create less of a problem than previously anticipated. Another barrier for implementing technology is cost. According to the SAP expert, an ERP system such as SAP would cost about US$800,000. Some interviewees, for example, the Head of IT at Company D, do not believe that cost would be a problem, as technology gets cheaper.

This research does not completely agree with this view because the cost of security systems and data storage equipment can still be high. However, the idea that technology is getting cheaper has some merit because there is evidence to suggest that ICT tools and software are getting cheaper in the market. For example, according to the managing director at Company D, the cost of communication software such as Net2Phone has reduced by 20 per cent over 3 years. (See also Section 5.2.2). As the cost of ICT reduces, more companies will integrate their systems. Many manufacturers set achieving integration as a goal. Most of the manufacturers believe that in the period after the MFA customers will select manufacturers based on integration with their

systems. The Head of IT at Company D comments that customers will use ICT as a selection criterion:

"The technology is changing at such a fast rate that, after the MFA finishes, customers would be much more selective who their manufacturers and suppliers would be. My feeling is that technology will pay a bigger role in that. They will not want to spend time on a phone call or send a PO in a snail mail. They should be able to do it electronically, even go beyond sending via e-mail. Doing electronically online that kind of thing is going to be very important…".

This section has identified that having an automated SC is an anecdotal benefit in this context due to several reasons including scale of operations (e.g. production volumes) and nature of the industry (e.g. mass availability of labour). The research also identified two anecdotal problems: protecting sensitive information and increasing high cost of ICT. At the initial stages of the research, integration between the systems appeared to be unrealistic because there is lack of coordination in the SC. However, the data suggest that a lead firm can facilitate the coordination so that all members in that SC implement compatible technology. Finally, the influence of the hyperbole created by the IT solution providers diminishes as more companies realise the true potential of EB.

7.5 Summary of PC-LF-RLF-AE

The objective of Chapter 7 was to establish current EB usage levels at the manufacturers. This Chapter presented data on issues such as EB capability and discussed other issues such as evaluation and expectations. This chapter answered three of the research questions, relating to EB usage at the selected manufacturers. Chapter 5 identified 'visibility' as a positive point that enhances EB capability. Chapter 7 examined visibility in more detail. It appears that Companies A and C are able to achieve visibility because of integration with their respective long-term customer. According to the data, the EB capability levels among the manufacturers, from high to low are Companies C, A, B, D and E. The data suggested that Companies D and E have trouble with their current systems. It appears that constant communication breakdowns and systems failures are common occurrences at Companies D and E. Chapter 7 developed the findings from Chapter 6 to understand the link between relationship strength with the customer and EB capability. The insights from Chapter 6 outlined that

relationships with external entities in the SC are important to understand communication problems. There is evidence to suggest that all companies undertake some level of ICT evaluation. All the companies consider cost to be the most important criterion for ICT evaluation. Company A believes that evaluating a software programme or a computer system is difficult because of contributing variables. Companies A and C indicate similar criteria when evaluating ICT tools. It was useful to identify evaluation criteria because the findings from Chapter 6 suggested that manufacturers are implementing ICT according to their customer's advice. The data indicated that, in the case of Companies A and C, the customer plays a prominent role in deciding the type of technology implemented. The final section of this chapter concentrated on identifying future expectations of EB. The data suggest that manufacturers have high expectations of EB. It appears that the long-term expectation is to develop an automated SC. According to the data, the medium to short-term expectation is to achieve a totally integrated SC. The data suggest that companies A and C are the closest to achieving a totally integrated SC. Furthermore, the level of anecdotal benefits advocated by the IT solution providers diminishes as EB users identify the actual benefits.

CHAPTER EIGHT CONCLUSIONS

8.1 Introduction

This final chapter provides an overview of the main features of the research, covering the aim, themes, research questions, findings by category combinations, conclusions, contribution to knowledge, limitations and recommendations for further research. The conceptual model developed by this study contains interlinked category combinations derived from the TAC framework (see Table 8.2). The model is based on the field research undertaken in Sri Lanka between 2003 and 2004. This model provides a structured platform to analyse the main findings of the research concerning ICT usage in SCM operations in the context of a SC between a retailer from a developed economy and an apparel manufacturer from a developing economy, Sri Lanka, as discussed in Chapters 5, 6 and 7.

8.2 Aim

The aim of this research was to evaluate:

The effectiveness of e-Business on supply chain operations, (i.e. its influence on information sharing and buyer-supplier relationships), compared to previous information communication technology.

In meeting this aim, it is demonstrated that information sharing and buyer-supplier relationships are interrelated and operate at a symbiotic level, supporting the views of authors such as Closs *et al* (2005) and Sheu *et al* (2006) who provide evidence to suggest that collaborative relationships are essential for effective use of e-Business in SCM. This is discussed in Sections 2.3, 2.7.4 and 2.10. For related findings, see Section 6.2.

The findings indicate that e-Business has made substantial improvement to communication channels at an intra-organisational and an inter-organisation level. Compared to previous communication methods such as fax or telephone, communicating with e-Business tools is more effective for several reasons. Principally

e-Business tools provide more control over business because of its superior information sharing capability. E-Business tools are more suitable to disseminate information because of their innate ability to modularise and synthesise data efficiently. For example, information received by an e-mail can be fragmented as appropriate and distributed to relevant recipients and visa versa. This visibility provides many opportunities to business. For example, the ability to share graphic files has improved the clarity and quality of product designs and reduced cycle time and administration costs. Visibility has transformed conventional business methods because of its ability to involve several people interactively to share opinions in real-time.

8.3 Thematic approach

In order to undertake this investigation, a thorough understanding of the current use of ICT was important, coupled with a clear view of the SC in terms of entities, activities and relationships involved. A themed approach was decided as being most suitable, following insights gained from an exploratory study. This study employs four themes to explore the research aim: level of information sharing (LIS), type of information sharing (TIS), buyer-supplier relations (BSR), and actual impact vs. perceived impact (AI vs. PI).

8.4 Research questions

This study formulated 12 research questions, based on the literature, mentioned below in Table 8.1 according to category combinations. These questions evolved in parallel with the literature review to produce definitive research questions. The literature review revealed that there is a lack of information to answer these questions.

Table 8.1 Research questions according to category combinations

Research questions	Category combinations
1. Why do some companies believe e-Business adds value to the organisation? 2. What are the benefits of e-Business? 3. How important is information sharing in the apparel supply chain? 4. What are the negative aspects of information sharing, if any?	PC-LF
5. Why do some companies implement new ICT tools to facilitate E-Business? 6. Who influences the decision to migrate to a new ICT system? 7. Who controls the information sharing policy? 8. How can suppliers preserve competitiveness in a total information transparency supply chain? 9. What type of information sharing policy do they use?	PC-LF-RLF
10. How do current e-Business users position themselves in terms of usage? 11. What criteria can be used to evaluate an ICT tool? 12. Why do companies have high expectations from new ICT such as E-Business?	PC-LF-RLF-AE

TAC framework categories: platform capability (PC), level of functionality (LF), role of the lead firm (RLF) and appropriateness of expectations (AE)

8.5 Findings by category combinations

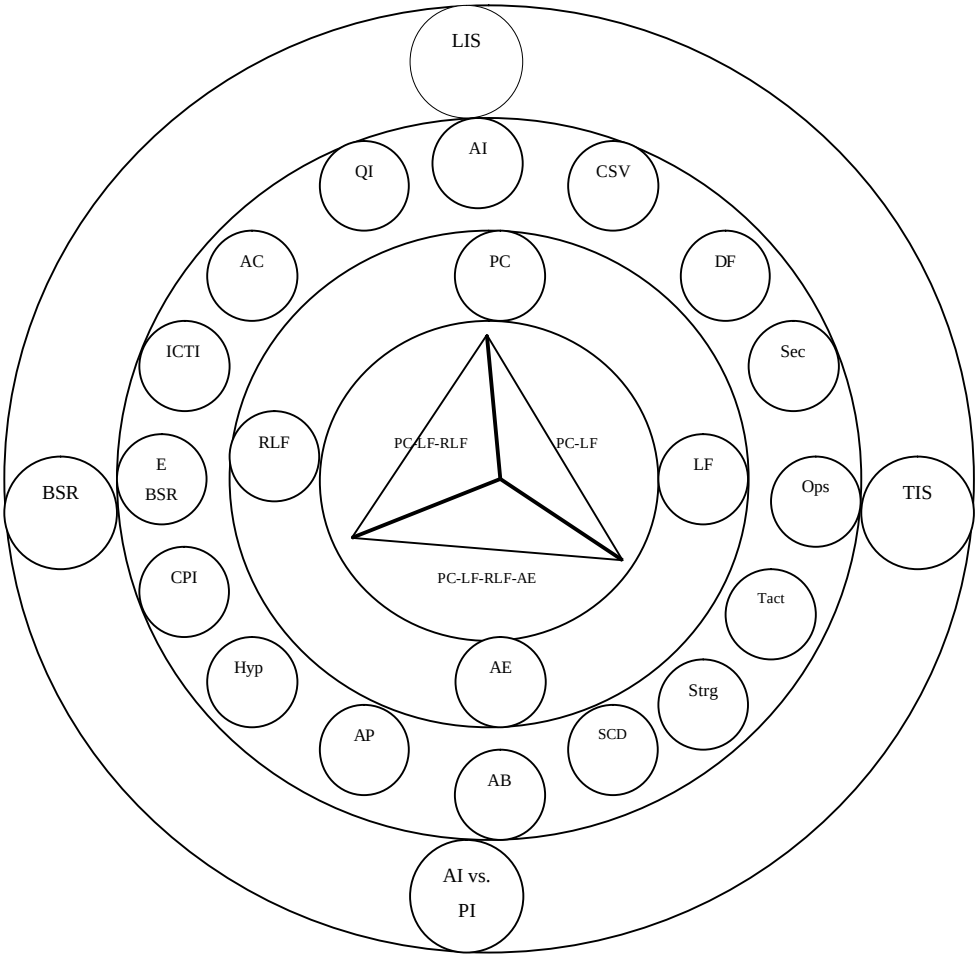
The purpose of this section is to demonstrate how the research questions were answered with empirical evidence. The questions were answered using category combinations identified from the TAC framework. Table 8.2 lists abbreviated components of the TAC framework. A summary of the findings are provided in Sections (8.5.1-8.5.3), grouped according to three category combinations. The findings of the research are presented according to the aim stated in Section 8.2.

Table 8.2 TAC framework with abbreviations

Themes	Attributes	Categories
Level of information sharing (LIS)	Quantity of information (QI)	Platform capability (PC)
	Accessibility of information (AI)	
	Cross structural visibility (CSV)	
	Data filtering (DF)	
	Security (Sec)	
Type of information sharing (TIS)	Operational (Ops)	Level of functionality (LF)
	Tactical (Tact)	
	Strategic (Strg)	
	Shift in communication with different ICT (SCDICT)	
Buyer supplier relationships (BSR)	Effects on BSR (EBSR)	Role of the lead firm (RLF)
	ICT Implementation (ICTI)	
	Access control (AC)	
Actual impact vs. Perceived impact (AI vs. PI)	Communication platform integration (CPI)	Appropriateness of expectations (AE)
	Anecdotal benefits (AB)	
	Anecdotal problems (AP)	
	Hyperbole contributing to industry perceptions (Hyp)	

Figure 8.1 provides a collated depiction of the research components at four levels of analysis. The outer circle presents four themes, which provided the foundation for this research. They are: level of information sharing (LIS), type of information sharing (TIS), buyer supplier relationship (BSR) and actual impact verses perceived impact (AI vs. PI). The inner circle lists 16 attributes relating to the four themes. This means that there are four groups of attributes.

Figure 8.1 'Snap Shot' - Ariel view of the formation of aspects involved with understanding the impact of e-Business on B2B segment of the supply chain



Abbreviations stated in this diagram are explained in Table 8.2

Before the data analysis there were 12 attributes derived from the literature review. According to insights gained from the field data, four more attributes were included. The next circle contains four categories to reflect changes made to the attribute groups. This means that categories act as a label to represent the existing attributes. Finally, the category combination in the middle facilitates deeper analysis building on three levels as depicted in Figure 8.3 Each of the combinations is discussed in sub-sections as summarised in Table 8.3. Note that further details of the answers are provided in Section 8.6.

Table 8.3 Impact of e-Business on SCM from an apparel manufacturer's perspective

Category Combination	Perspective	Components
PC-LF	Internal	Positives Negatives Barriers
PC-LF-RLF	External	ICT implementation Access control
PC-LF-RLF-AE	Holistic	Current status Evaluation Expectations

The category combinations are interrelated and facilitate a deeper level of understanding in ascending order regarding the impact of e-Business on SCM (see Section 4.3). Adding of a category to form the subsequent combination provides another dimension, whilst preserving the balance of the research parameters by linking the analysis to the previous combinations (see Section 4.2.2).

8.5.1 First combination PC-LF

This combination revealed internal reasons for a manufacturer to exercise ICT implementation. From an internal perspective, there are 21 benefits realised as a result of implementing new technology. The purpose of these particular research questions was to identify the importance given to ICT tools and information sharing by apparel manufacturers. This study reports the first evidence of the practice of the apparel industry in Sri Lanka.

Research questions 1, 2 and 3: Positive internal reasons for ICT implementation

The findings identified 21 positive reasons why manufacturers are in favour of using ICT in their SC (see Table 5.1). Several of the benefits of ICT identified by this research agree with the claims of authors such as Min and Galle (1999), Chopra and Meindl (2001), Quayle (2002) and Auramo *et al* (2003). The findings of this study also support the research by Shore and Venkatachalam (2003) and Power (2005a), on performance improvements achieved from a coordinated information flow facilitated by e-Business.

Min and Galle (1999) stated*: e-Business can enhance opportunity for buyer supplier*

relationships (Min and Galle, 1999:910). Research by Chopra and Meindl (2001) identified that e-Business facilitates a*ggregating information from various sources, providing personalisation and customisation of information*, s*peeding up time to market and, improving supply chain co-ordination through information sharing*. The findings indicate that these benefits are created by e-Business. Similarly, Quayle (2002) mention*: EC has vast potential to facilitate collaborative planning among supply chain partners by sharing information (Quayle, 2002:1149).* The findings indicate that a strong relationship is vital for conducting e-Business and therefore e-Business acts as a catalyst to improving buyer-supplier relationships.

Research question 4: Negative impacts (internally) of information sharing through ICT tools

This research identified nine negative impacts of information sharing through ICT tools. The areas affected are: security, touch/feel fabric, high cost, redundancy[32], ICT dependency, reliability, lose of human integration/rapport and, wrong estimates (see Table 5.2). The security aspect is recognised as the predominant concern by all manufacturers. This issue is scarcely discussed in the literature as outlined by Delfmann *et al* (2002). This finding agrees with authors such as Cunningham and Fröschl (1999), Chaffey (2002) and Silveira and Cagliano (2006). These authors mention that security is the Achilles heel for information sharing through ICT tools[33].

The study also identified five factors acting as barriers for ICT implementation (see Table 5.3). These are geographic distance, country infrastructure, remote plant location, people, and culture/change issues. In the Sri Lankan context facilities to use ICT is mainly confined to the commercial cities of Colombo, Galle and Kandy. Sri Lankan apparel manufacturers face difficulties connecting their head offices in Colombo with manufacturing plants in rural areas. This situation has created a dilemma for government authorities. Limitations in available resources such as material (e.g. fibre optic cables) force the authorities to prioritise to either serving many in urban areas or providing for few apparel factories in rural areas. After the privatisation of the Sri Lanka telecom, this situation has improved, however. Further, competition among the

[32] Fewer staff are required to operate as e-Business is able to streamline data exchange.
[33] This does not apply to when using dedicated lines.

telecom providers would benefit infrastructure development.

8.5.2 Second combination PC-LF-RLF

Evaluation of this combination identified external reasons for manufacturer's ICT implementation. The research questions under this combination sought to understand the influence of an external party, such as the retailer on practising information sharing. Two areas were identified as affected by a lead firm controlling information sharing in the SC: firstly in terms of ICT implementation and secondly in terms of access control.

Research questions 5 and 6: External influences on ICT implementation

The findings indicate that there are internal and external reasons a manufacturer implements ICT tools. Internally, the manufacturers have realised the improvements in their functions from the new technology they already have and are encouraged to undertake further implementation after seeing the benefits. The 21 internal reasons were discussed under the first combination PC-LF. Externally there are two reasons a manufacturer implements ICT tools.

Firstly, an influential second party has advised them to do so. The company's dependence on an external party, such as the customer, influences them to implement the proposed technology. The findings further develop research by Power and Simon (2004) and Power (2005a and 2005b) in terms of technology implementation and integration. Power (2005a) discusses performance improvement due to new ICT tools. The findings in this research provide details on the areas that have improved as a result of implementing ICT tools. Power (2005b) discusses adopting a SC wide perspective for technology implementations and the interactions between participants. This research provides evidence to suggest that the role of the lead firm (RLF) plays a crucial part in technology implementation. The findings develop discussions by Christopher *et al* (2004), Guercini and Runfola (2004), Croom (2005) and Moedas (2006) regarding the dominant player controlling the apparel SC for technology implementation. This research identified that a manufacturer operating with one customer, in a long-term relationship, with fewer products tends to be more likely to comply with that customer's request whereas, when a manufacturer has multiple customers with ad hoc relationships and a wide product range, this manufacturer appears to be less committed to implant a

particular type of technology as instructed by the customer.

Secondly, manufacturers are misinformed by the hyperbole fed by the IT providers. Ambiguity surrounding the capability of new ICT tools created by aggressive advertising has led to unwarranted investment in technology. This finding supports Cagliano *et al's* (2005) views on the influence of hyperbole. This issue is discussed further under the third combination PC-LF-RLF-AE.

Research questions 7, 8 and 9: Access control

The findings on the situation regarding information flow between manufacturer and customer revealed that information is exchanged, as required by the customer. The findings indicate that there is a positive connection between the manufacturer's dependence on the customer and the level of information available to that customer. These findings agree with Cox *et al* (2004) and Simatupang *et al* (2004) on the level of interdependence of information sharing. The findings further develop Svensson (2002b) on the dominant player influencing a vulnerable partner. This research provides details of particular scenarios and the extent to which this influence occurs.

The second area of findings identifies the consequences (for the manufacturer) of facilitating a transparent information system. The findings indicate that, in this context, sensitivity of information is low because of the 'low-tech' nature of the product. Therefore dangers from the information falling in to the wrong hands would be minimal. Because of the level at which these manufacturers operate, the competition comes only from foreign manufacturers and as a result losing competitive advantage due to information sharing is not a main concern. This finding therefore does not support the discussion by Swaminathan *et al* (1995) regarding the transparency of sensitive information leading to loss of orders. Swaminathan *et al's* (1995) finding therefore does not seem to apply to the apparel industry.

The findings on information sharing policy indicate that companies are not using such a policy at present but all of the participants agree that it is an important area to consider before facilitating integration. There is a gap in the literature discussing information sharing policy.

8.5.3 Third category PC-LF-RLF-AE

This combination achieved a holistic view of ICT implementation in SCM by combining internal and external perspectives. The main purpose of this combination was to evaluate the gap between EB capability and usage. The summary of findings for the final three research questions relating to ICT tools are presented below in terms of current use, evaluation and expectations.

Research question 10: Current level of ICT usage

The first area provides findings on an e-Business capability spectrum. The findings indicate that a benefit such as 'visibility' would only be possible for manufacturers at the higher end of the spectrum (i.e. companies C and A). There is a direct connection between relationships and e-Business capability. This means that stronger relationships facilitate higher levels of e-Business. Manufacturers C, A and B are satisfied with their information flow. Manufacturers C and A even admit to having the capability to generate more information than they actually need. Due to the high level of information available to manufacturers C, A and B, the need to communicate on a regular basis with the customer is far less compared to manufacturers at the lower end of the spectrum (i.e. companies D and E). Manufacturers at the lower end of the spectrum have lost several important customers due to poor information flow. The findings show that poor communication levels have created additional echelons in the SC in terms of field offices and buying offices.

The findings in this area further develop the views of Todeva and Konke (2005) and Sheu *et al,* (2006), on the importance of collaborative relationships for facilitating e-Business. This research explains that collaborative relationships are vital for facilitating compatibility of ICT tools and therefore a major requirement to achieving integration. They also support Cagliano *et al's* (2005) and Croom's (2005) discussions on technology implementation and level of e-Business usage. The finding on the involvement of additional echelons due to poor communication supports Popp's (2000) view of SC structures in the apparel industry.

Research question 11: Evaluation

The second area of findings indicates how ICT tools are appraised by the manufacturers. The findings in this area revealed that, so far, intangible aspects such as motivation and morale are not included in the evaluation criteria list. The findings also indicate that ICT has improved the motivation and efficiency levels in the workforce. The main criteria used for evaluating an ICT tool are cost, customisation and technology. There is a lack of literature discussing criteria for evaluating ICT tools. It appears that, so far, literature only includes the performance of ICT tools and ignores evaluating the ICT tool in its entirety. For example, the ability to customise an ICT tool is essential for facilitating compatibility. This research further develops the views of Auramo *et al* (2003), Iyer *et al* (2004), Power and Simon (2004) and Cagliano *et al* (2005), on evaluating the performance of ICT tools. For example, Iyer *et al* (2004) identify extensive visibility, real-time information, and streamlining processes as some indicators of performance measures of ICT tools. This research provides evidence to suggest that visibility is a major criterion for measuring the level of e-Business. The findings identified 21 benefits of e-Business that makes a useful contribution to improving performance. These benefits vary between the five companies. The number of benefits achieved by a company could be used as an evaluation of that company's ICT tools.

Research question 12: Expectations

The third area includes findings on expectations of e-Business. The findings indicate that there is strong hyperbole created by IT solution providers claiming anecdotal benefits and problems. This area provides findings on the substantive capabilities and limitations of e-Business. The findings indicate that, based on hyperbole, some manufacturers expect to achieve a fully automated SC in a short period. According to the findings, there are two reasons an automated SC is unrealistic in this context. Firstly, the volumes currently produced by Sri Lankan apparel manufacturers are too small to justify an automated system. Secondly, in a labour intensive industry, implementing an automated SC may not contribute to competitive advantage. The findings indicate that anecdotal benefits are appreciated by enthusiastic IT departments, whereas anecdotal problems appear to act as a safety net for manufacturers that are reluctant to change their views on new ICT methods. Findings on the issue agree with the views of Cagliano *et al* (2005) that the true potential of e-business is difficult to identify, due to

hyperbole. The findings further develop the discussion by Cagliano *et al* (2005) by identifying the extent of hyperbole and the manner in which it is able to influence the apparel sector in Sri Lanka.

Compared to previous ICT e-Business provides substantial benefits to improve competitiveness. From an internal perspective, e-Business improves the efficiency and effectiveness of operations and transactions. Externally e-Business acts as a lever to amalgamate SC entities to act as a unit. This creates a sustainable platform for developing SC strategy.

8.6 Conclusions

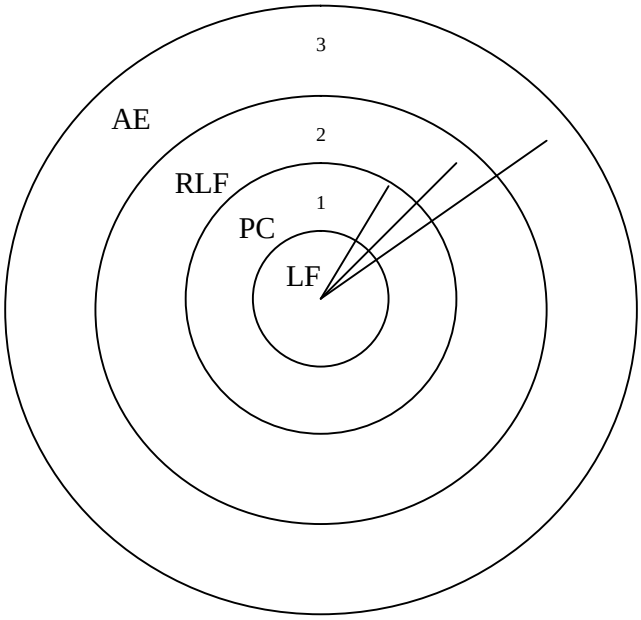
As discussed in Chapter 1, the aim of the research is to identify:

The effectiveness of e-Business on supply chain operations, (i.e. its influence on information sharing and buyer-supplier relationships), compared to previous information communication technology.

The literature review concluded that the concept of SCM is based on buyer-supplier relations. This study focused on identifying the concurrent flow of information between the entities from the manufactures' perspective in a SC, specifically, information sharing using ICT tools for conducting e-Business and its ability to provide a platform to satisfy the communication requirements.

The data analysis was conducted using an innate analytical framework containing theme, attributes and categories (TAC). A conceptual model was constructed by synthesising 4 categories (see Section 4.2.2). The 4 categories identify internal, external and contextual issues by amalgamating with one another as depicted in Figure 8.2.

Figure 8.2 Study of categories



1. PC-LF Internal issues 2. PC-LF-RLF External issues 3.PC-LF-RLF-AE Contextual issues

An evaluation of the categories identified that PC subsumes LF. This is because the capability of a system decides the level of functionality. For example, to use an ICT tool such as VMI to facilitate transactions, a system must have connectivity and a decoding programme to visualise the data. This means that functionality would depend on software and hardware capabilities. However, LF deserves recognition separately because LF identifies the types of activities involved (e.g. inventory management and raw materials purchasing), has its own set of attributes and forms an integral part of the category combinations.

Organising the SC to ensure technology compatibility is a key requirement for conducting e-Business. The lead firm appears to undertake this role by creating an integrated platform. The degree of dependence on the lead firm determines the level of compliance shown by the manufacturer for technology implementation. This means that RLF directly influences PC and therefore LF. For example, the lead firm controls raw material sourcing in the SC. Therefore, even if the manufacturer has the platform capability to source for suppliers, this function occurs according to the lead firm's discretion.

In order to compete with rival SCs technological expectations are set by the lead firm for the whole SC. This means that evaluating the suitability of technology is essential. However, contextual issues, such as hyperbole, may influence the lead firm's perceptions on strategic implementation of technology. Therefore, the influence from AE impacts on RLF and subsequently on PC and LF.

The evidence of this study suggests that E-Business improves the effectiveness of SC operations. All the participants recognise it has made a positive impact in their SCs. The traditional view that 'timesaving' is the most important benefit of e-Business does not seem to apply in this context. This is because of the geographical distance between the manufacturer and the customer (see Section 7.2.2). In this context, the most important benefit is considered to be 'visibility' because it allows viewing another entity's data to enable smooth operations of vital processes. This does not mean that time savings at an intra organisational level are unappreciated by the apparel manufacturers. In fact, e-Business clearly 'adds value' to an organisation by facilitating several benefits based on time management. This is because a number of benefits such as faster cycle times, real time information, problem prevention through early detection, and clarity of information, help to maintain internal processes at the scheduled time. A high degree of importance is given to information sharing because the number of benefits achieved by a company increases as they use more advanced level of e-Business. Consequently, new forms of ICT become more and more important. Data suggests that there can be a loss of human interaction or rapport due to e-Business. The finding that 'e-Business facilitates better BSR' is challenged by the way e-Business operates. This is because this generation of ICT users are operating with a mindset that requires them to have face-to-face interactions to form relationships. It could be concluded that as ICT tools become more prominent, the belief that e-Business is impersonal would change. It is certain that in the future communications would be conducted by new ICT and this trend is likely to continue to expand.

Furthermore, degree of visibility determines the level of performance of an organisation. This suggests that visibility could be used as a performance-measuring objective. While all the participants agree there is greater understanding of advantages they also showed understanding of disadvantages and dangers of integration. The balance between advantages and disadvantages of integration is identified by the visibility issue. Participant companies had different attitudes towards how much

integration is required and how much they want to show to the lead firm. This is an ongoing problem because the manufacturers have to decide to what extent they want to rely on one particular customer and to what extent they want to retain control.

In general SCs in a particular sector are similar in terms of the processes but entities respond differently to take up and application of e-Business. Consequently the extent, capability and use vary between the firms although there is a general trend to greater take up of technology. The difference mainly depends on the collaborative relationships and information sharing. The nature of the relationship with the lead firm plays an important role in technology implementation. Although the lead firm plays a central role in adopting and implementing e-Business it does not mean that manufacturers have no power in the matter. While a SC in which the garment manufacturer supplies most of his capacity to the lead firm accepts more influence from the customer garment manufacturers with more than one customer have more discretion as to what they adopt and how they will implement that technology.

The type and use of ICT also depends on the nature of the industry. This means that industry context is a vital area to consider when implementing ICT. This is because the 'rules of the game' for every industry vary. For example, the car industry is more tightly knit than the apparel industry. The apparel sector has entities that do not want to be tied down because of the risk they would face in case their customer terminated their contract in favour of cheaper labour charges and shifting to another destination. An entity in the automobile SC is unlikely to be terminated hastily due to high switching costs.

The findings indicate that the most prominent barriers, country infrastructure and remote plant location, are specific to a developing economy context. Presently there are government initiatives, such as 'e-Sri Lanka' conducting programmes such as 'Vishwanyane Kendraya', which are facilitating infrastructure and Internet access points to the rural areas with the view of using the Internet as a catalyst for development and regeneration of export commodities. The dilemma faced by the telecom providers is whether to upgrade facilities for urban dwellers or connect factories in rural areas to the network. The general status of the infrastructure is improving but it still lags behind western standards. The uncertainty of the future creates a risk for telecom providers in tackling this trade-off because if the factories in rural areas become redundant the

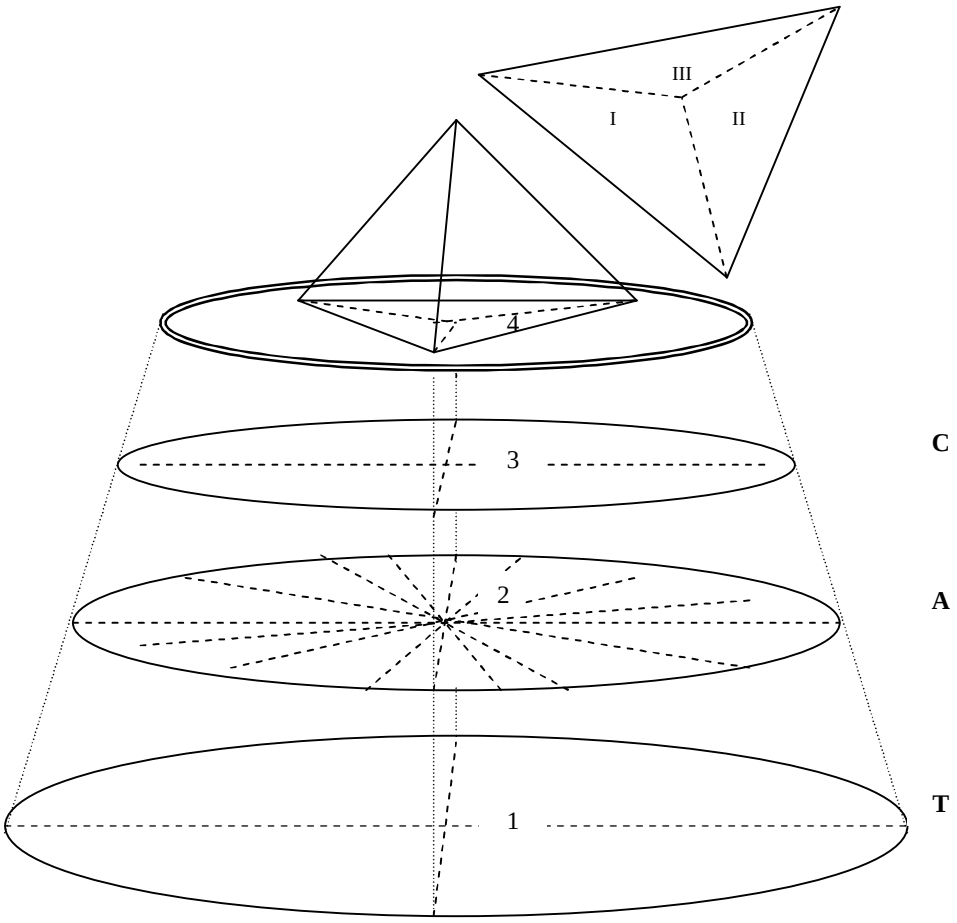
telecom providers would incur heavy loses.

Although there is considerable hype about e-Business in general respondents were aware of the benefits and disadvantages and the extent to which they actually need EB applications. In practice the influence of the lead firm appeared stronger than the hype of marketers. Communication technology is driven by knowledgeable senior management who gives a high level of importance to modern methods. For example, in house communication technology implementation development is common among all manufacturers. The technicians are sent abroad for training to countries like Germany and the USA.

The TAC framework was developed to analyse considerable data collected during interviews. It was effective in analysing the data and provided a useful and robust tool to structure this research. The analytical tool developed by this research would be applicable to other studies examining the apparel industry pursuing similar inquiries or for research in to other industries, which operate in a similar context. The literature indicates that the nature of SCs is heterogeneous and depends on the particular sector. The differences depend on the product/service, relationship dynamics between the entities and overall control of the SC. However, there are similarities in all SCs such as information sharing, which requires compatibility of technology between the entities to achieve an integrated platform.

The themes and categories in the analytical tool are, moreover, generic for identifying the impact of information sharing in a SC. However, even though the attributes are mostly generic, they may require reconfiguration according to the specific needs of an industry. This means that the second level in Figure 8.3 may be reconfigured according to industry.

Figure 8.3 'Snap Shot' Vertical 3D view of the formation of aspects involved with understanding the impact of e-Business on the B2B segment of the supply chain



I. PC-LF II. PC-LF-RLF III. PC-LF-RLF-AE

First level contains four themes; Second level contains 16 attributes; Third level contains four categories; Fourth level contains three category combinations.

For example, in the automobile sector the focus is placed on the product itself, whereas in the apparel sector the focus is given to delivery of shipment at the agreed time for replenishing stock. In addition, in the automobile industry, the manufacture controls the supply chain rather than the retailer. This means that activities such as sourcing for raw material suppliers and technology implementation are controlled by the manufacturer. Furthermore, the manufacturer takes an active role in developing the suppliers to improve the standard of the product. Because of this reason 'supplier management'

takes a central focus in the automobile sector compared to the apparel industry. Therefore, the TAC framework may be developed by further research.

8.7 Research contribution

This research makes a theoretical and operational contribution to current knowledge in the field of ICT implementation in SCM. Specifically, this study makes a contribution to understanding the paradigm of buyer-supplier relations and its impact on ICT implementation. The literature review revealed that previous studies expressed a need for further research in the areas:

1. 'international SCM' (authors such as Leonidou and Kaleka, 1998; Harland *et al*, 1999; Fynes and Voss, 2002; Fynes *et al*, 2005; and Moedas, 2006),
2. 'relationships in apparel SC' (Chandra and Kumar, 2000; Bruce *et al*, 2004 Christopher *et al*, 2004 and Guercini and Runfola, 2004;),
3. 'e-Business in Operations Management' (Silveira, 2003; Cagliano *et al*, 2005 and Croom, 2005),
4. 'ICT implementation and BSR' (Murillo, 2001; Frohlich, 2002; Sahin and Robinson, 2002; Power and Simon, 2004; Power, 2005a and Power 2005b and Silveira and Cagliano, 2006),
5. 'controlling firm's influence on information sharing' (Walsham, 1993; van Hoek, 2001; Cox *et al*, 2004; McIvor and Humphreys, 2004 and Simatupang *et al*, 2004).

The study develops understanding in the areas of BSR and information sharing. The thesis integrates the two areas and for the first time examines the concept of a lead firm's role in an e-Business enabled SC in this context. The contribution made by this research includes:

- Adding to the growing consensus regarding the importance of 'visibility' and explicitly demonstrating that in the context of the Sri Lankan apparel industry 'visibility' is the main objective for implementing ICT tools, countering the previous notion of 'time saving' the main advantage. This study demonstrates

that visibility directly affects the performance of an organisation and therefore adds visibility to the existing performance objectives[34].

- Developing understanding of the role and behaviour of the controlling firm in the SC as a basis to formulate substantive theory on the concept of the role of the lead firm
- Developing an analytical tool and a conceptual model for analysis of 'the impact of e-Business on SCM', providing an internal, external and a combined holistic approach in order to establish a detailed understanding of its operations. The themes, categories and subsequently the category combinations developed by this research are generic in nature and, consequently, could be used to identify the information sharing approach with ICT in SCM. Therefore, the analytical tool and the conceptual model could be relevant to further research undertaken in the apparel sector in a similar context or research into other sectors involving a similar inquiry
- Revealing Sri Lankan apparel industry practices on ICT implementations and use. The qualitative data collected during fieldwork revealed the personal opinions of e-Business users. This level of detail is not available in existing literature
- Evaluating apparel industry practices on information sharing and providing evidence to demonstrate the importance of an information sharing policy.

8.7.1 Use of TAC for academic and business communities

After explicitly answering the twelve research questions it would be useful to provide a summary of the important findings and their implication for researchers and practitioners. With this aim this section provides recommendations and proposals. Table 8.4 provides a summary of findings which are considered by this research to be most useful.

[34] Slack *et al* (2001) indicate performance objectives: cost, quality, speed, dependability and flexibility.

Table 8.4 contribution from the TAC framework and main findings

Finding summary	Academics	Practitioners	Comments
Main benefit from EB *Visibility is more important than speed in the lean sc*	Adds to list of performance objectives: cost, quality, speed, flexibility and dependability	Visibility is important for both lean and agile supply chains	Visibility was previously associated only with responsive or agile sc. Findings indicate that visibility reduce risk and waste
ICT evaluation *Impact of ICT implementation on motivation and moral*	Identifies employee perceptions from their perspective. The real users perspective may provide a accurate picture	Intangible aspects needs to be considered because they are less obvious but equally influential	Better representation of ICT impact on the organisation. Production floor employee feeling as a valued member and consequently increase their commitment to using ICT tools
Information sharing policy *Access control*	Data flow restrictions vs. channel integration. Important to clarify channel structure and compatibility of systems	Selecting transparency levels to safeguard against short term ad-hoc relationships. This is especially useful for sourcing accessories suppliers	An agreement between the echelons indicating the level of transparency they are willing to participate. Additional information regarding a process or another entity may be supplied based on a separate agreement
Role of the lead firm *ICT implementation*	SC environment for technological development. Compatibility between the entities for communications systems integration	Understanding the scope for future technology adoption. Strategy for coping with the technological changes made by the dominant entity	ICT policy setting goals and objectives to establish future technology use. Indication of commitment to implement compatible technology agreed by all the entities
International trade between a developed and a developing economy *Types of relationship between manufacturer and retailer*	Inter dependency between the dependent and provider. Identifying vulnerable scenarios and coping strategies for the submissive partner	For manufacturers from a developing economy safe guards against trade exploitation and participate in decision making on issues such as selecting materials supplier	Understanding relationship dynamics between entities operating in an global SC. The influence of economical and knowledge superiority on behaviour

8.8 Reflections on and limitations of the research

This study encountered several limitations along the research path due to its approach and availability of resources. The limitations are identified according to research methodology, context and sample size. The limitations of the research are as follows:

- Size of sample
- Context of one industry

- Understanding interviewee perceptions and author bias
- Observes only one echelon in the SC

The reason that the research philosophy is considered from a qualitative view presents some inherent limitations such as the possibility of misinterpreting interviewee perceptions and author bias. The research environment presented a linguistic and cultural mix in the participants (see Section 3.5.2.3). Despite contingencies to overcome miscommunication, achieving absolute clarity cannot be guaranteed. During field work and subsequently at the data analysis stage considerable care was taken to avoid author bias. The fact that the research environment is the country of origin of the researcher may have caused some level of attachment to the issues under investigation.

One methodological limitation of the study is recognised as the size of sample. The original plan set out by the research methodology contained a survey method. This was later discarded on the basis that the area of e-Business is a new field and some questions need explanation prior to recording answers. The advice given by the EDB reinforced this view. However, the absence of a survey limits the opportunity to triangulate the data further and improve the generalisability of the empirical findings.

The unit of analysis selected as the research strategy observes a single echelon in the SC based on a single industry. This selection was inevitable considering the available resources. By restricting the research to a single segment of the SC in a single sector, a wider view of the phenomenon is not possible. An understanding of the entire SC, as opposed to one particular segment, would add to the findings by providing the opportunity to follow insights in the context of the whole SC and improve triangulation of the collected data. A cross-industry perspective provides the ability to compare how the findings may apply to a variety of sectors and establish a broader understanding of SC operations.

Contextual issues presented difficulties in increasing the number of companies which could be included in this study. One requirement of sampling was to select participants according to their use of ICT tools (see Section 3.4.1). In the chosen research environment, few participants qualified as suitable subjects. The available sample size limits this study's ability to generalise the findings to a greater extent. Nevertheless, this research was able to obtain a substantial volume of qualitative data.

8.9 Recommendations for further research

This study outlines several areas for future research. Some were identified from the literature review and several others emerged from analysis of the findings. Four areas are highlighted below:

- Comparison of apparel industry information sharing practices between two similar contexts e.g. Sri Lanka and Indonesia

The generalisability of the findings from this research may be somewhat limited as only five companies were examined. However, the findings may be applicable to other developing countries due to the similarities in the context. It would be interesting to test the findings revealed from this research in another context like Indonesia. For example, the level of dependence on the lead firm (retailer) and the appropriateness of components contained in the TAC framework could be further investigated. Specifically it would be useful to determine whether the attributes differ in another country operating under similar conditions.

- Role of the lead firm

There is a lack of research discussing the behaviour and role played by a lead firm. This research identified issues regarding the behaviour of the lead firm in terms of control of the SC according to level of dependence, technology implementation and access control. These two activities (i.e. technology implementation and access control) only provide a partial view of the lead firm's role. More information is required to establish a complete picture of the role played by the lead firm. For example, an apparel retailer's SC has other activities like sourcing raw material suppliers and down stream channel management, which are not covered by this thesis. Further research could consider the retailer's perspective to substantiate the findings made by this research. Such a study could identify the level of involvement of the manufacture in the decision-making concerning the entire SC. Also, it would be interesting to consider the whole SC to identify the lead firm's influence on other entities. This would enable a deeper understanding of SC operations. Additionally, a cross-industry study of a lead firm's role would provide a comprehensive account of SC BSR dynamics according to

different sectors.

- Information sharing policy in single and multiple supplier situations

The literature identified that there is a serious lack of research in the area of an information sharing policy. According to the findings Sri Lankan apparel manufacturers are not using such a policy at present but all of the participants agree it should be a priority before integrating their systems. Further research could investigate the suitability of using such a policy according to different segments and sectors. Also, further research could investigate appropriate guidelines for an information sharing policy in single and multiple supplier situations.

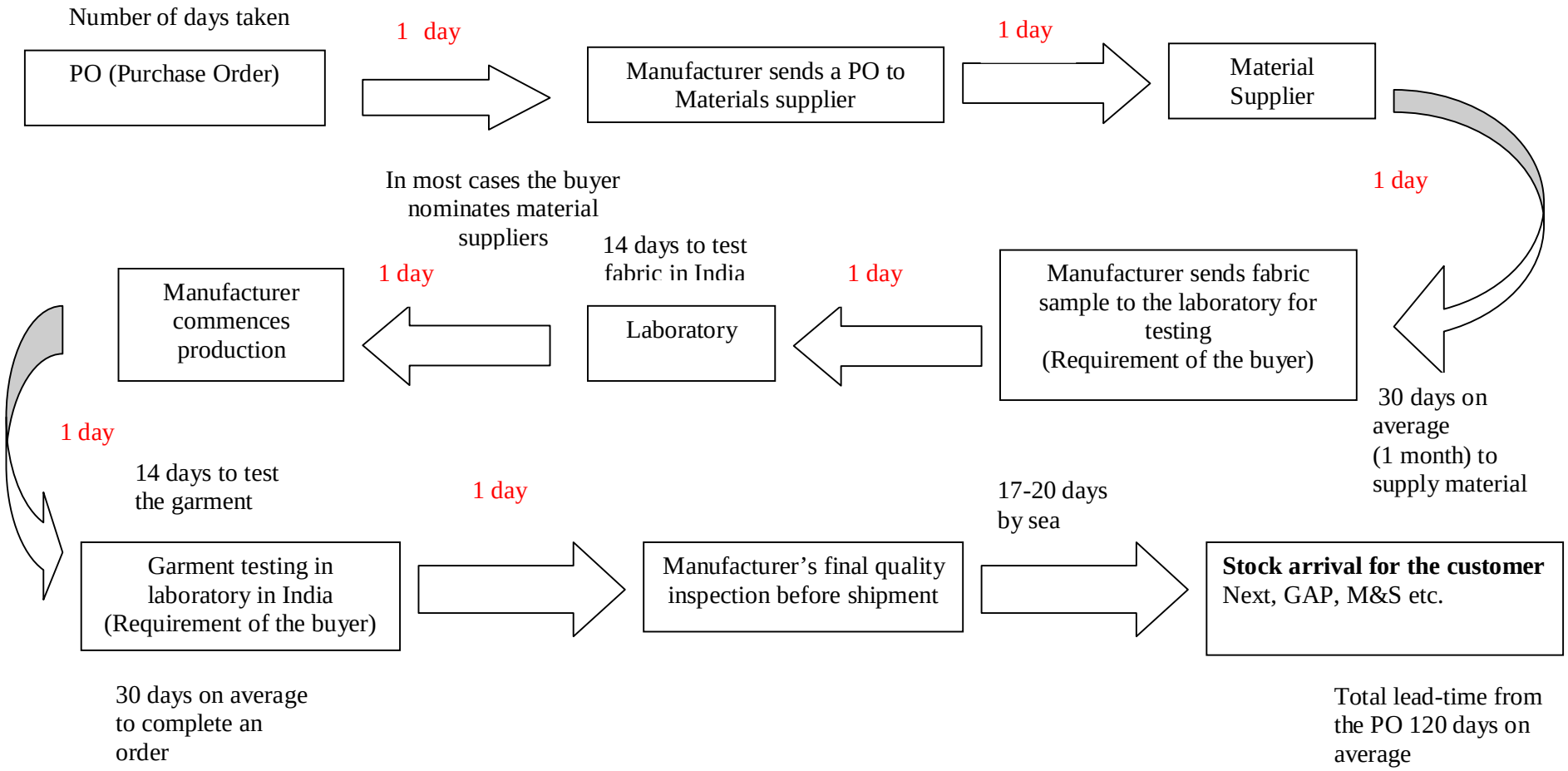
- Longitudinal study of the research

This research used a cross-sectional view with a historical background to capture a 'snap shot' of companies at a particular point in time. Very rarely has research in this area adopted a longitudinal study. Further research could consider a longitudinal study of the research matter examined by this study. It would be interesting to establish whether a longitudinal study would produce similar findings. In particularly, further research could investigate the influence from the lead firm and the timeframe given to manufacturers to implement technology. Additionally, a thorough view of issues such as technology effectiveness and current level of usage could be researched because a longitudinal approach identifies changes in the interviewee opinions over time. This would provide a more comprehensive explanation of ICT evolution in SCM.

Finally, the growth of E-Business is inevitable as more ICT tools with better capabilities are implemented in SCM. Undoubtedly, the concept of SCM appears so promising because of rapid advancements in ICT. It is evident that SCs will adapt correspondingly to the changes required for using ICT. Consequently, further understanding of information dissemination practices will require continuing research on the relationship between supply chain management and E-Business if its full potential is to be exploited.

Appendices

Appendix A the supply chain management process from the point of purchase order to stock arrival in UK



Appendix B Summarised SWOT Analysis of the Apparel Industry

Strengths	Weaknesses
1. Reputation of being a quality apparel manufacturer for the mass market 2. Compliance with International Labour regulations 3. Relatively disciplined and skilled labour force and a trainable labour force 4. Reputed International Customer base 5. The product price 6. On-time delivery of Standard "all-season" products	1. Sri Lanka's geographical location 2. Limited knowledge about the international environments and recent global industry development 3. Isolation from trade partners and heavy dependence on local buying agencies 4. Lack of geographical diversification in terms of its overseas markets 5. Insufficient international and bilateral trade agreements to support the industry 6. Increasing cost of labour compared with other countries in the South-Asian region 7. Inadequate focus on developing backward integration linkages to support the industry 8. None-existence of Product design and new product development 9. None-existence of a Sri Lankan brand identity 10. No focused marketing strategy for the industry 11. Low productivity of labour, inefficient use of machinery and manufacturing processes 12. The industries limited access to technology 13. The relative cost of utilities 14. Inadequate access to external logistics and poor logistics infrastructure 15. Procedural delays and trade documentation inefficiencies 16. Lack of standardisation in the apparel industry
Opportunities	**Threats**
1. Sri Lanka to become a total service provider for the global apparel industry 2. Removal of the quota system 3. Promote Sri Lanka as a socially responsible manufacturer of apparel 4. The Free Trade Agreement (FTA) with India 5. Transition of products that require a high labour content 6. The positive impact of the government's peace 7. initiative	1. Rapidly changing trends in the retailing industry 2. Removal of the Quota System 3. Former socialist countries and the East European nations potential to become major suppliers for the EU Market 4. Global formation of bilateral and multilateral trade blocs 5. New entrants to the industry 6. Emergence of efficient international shopping hubs in the Asian region

Appendix C Export performance - Month of February and January to February 2001, 2003 & 2004

Se.no.	Product Sector	Month of February					January to February				
		2002	2003	% Growth	2004	% Growth	2002	2003	% Growth	2004	% Growth
1	Agricultural products	84.04	67.74	- 19.40	81.21	19.88	158.73	135.92	-14.37	166.05	22.17
1.1	Tea	59.35	47.62	-19.76	56.58	18.82	114.27	97.04	-15.08	115.26	18.78
1.1.1	Tea packets	17.12	10.62	-37.97	13.90	30.89	31.12	22.02	-29.24	27.37	24.30
1.1.2	Tea bags	7.23	7.43	2.77	7.92	6.59	14.78	15.52	4.98	17.31	11.53
1.1.3	Tea in bulk	28.79	23.77	-17.44	28.93	21.71	55.83	47.72	-14.53	57.73	20.98
1.1.4	Others	6.21	5.80	-6.60	5.83	0.52	12.53	11.78	-5.99	12.85	9.08
1.2	Natural rubber	2.09	3.88	85.65	5.61	44.59	3.68	6.76	83.70	11.34	67.75
1.3	Coconut	5.34	5.42	1.50	8.98	65.68	10.49	10.73	2.29	17.66	64.59
1.3.1	Desiccated coconut	1.28	1.14	-10.94	3.71	225.44	2.31	2.24	-3.03	6.65	196.88
1.3.2	Fibre & fibre products	2.75	2.78	1.09	3.33	19.78	5.33	5.14	-3.56	6.93	34.82
1.3.3	Others	1.31	1.50	14.50	1.94	29.33	2.85	3.35	17.54	4.08	21.79
1.4	Spices and other export crops	17.26	10.82	-37.31	10.04	-7.21	30.29	21.39	-29.38	21.79	1.87
1.4.1	Spices	11.39	5.31	-53.38	4.97	-6.40	20.66	11.05	-46.52	10.73	-2.90
1.4.2	Essential oils	0.36	0.22	-38.89	0.47	113.64	0.59	0.55	-6.78	0.70	27.27
1.4.3	Fresh fruit	0.30	0.47	56.67	0.45	-4.26	0.68	1.13	66.18	1.17	3.54
1.4.4	Vegetables	0.47	0.51	8.51	0.47	-7.84	1.01	1.04	2.97	1.09	4.81
1.4.5	Cashew nuts	0.02	0.05	150.00	0.11	120.00	1.04	0.12	200.00	0.29	141.67
1.4.6	Cut flowers & foliage	0.55	0.67	21.82	0.63	-5.97	1.05	1.23	17.14	1.34	8.94
1.4.7	Others	4.17	3.59	-13.91	2.94	-18.11	6.26	6.27	0.16	6.47	3.19
2	Fisheries Products	4.99	9.10	82.36	8.10	-10.99	9.49	17.70	86.51	18.44	4.18
2.1	Aquarium fish	0.40	0.56	40.00	0.48	-14.29	0.90	1.17	30.00	1.13	-3.42

2.2	Prawns	1.70	3.60	111.76	2.48	-31.11	3.42	7.77	127.19	6.12	-21.24
2.3	Others	2.89	4.94	70.93	5.14	4.05	5.17	8.76	69.44	11.19	27.74
3	Industrial products	276.15	297.76	7.83	295.98	-0.60	530.32	595.11	12.22	652.11	9.58
3.1	Diamonds, gems & Jewellery	19.39	25.87	33.42	31.27	20.87	36.48	55.15	51.18	73.24	32.80
3.1.1	Diamonds	14.46	20.73	43.36	21.19	2.22	18.75	34.94	86.35	44.77	28.13
3.1.2	Gems	4.04	3.78	-6.44	9.09	140.48	15.24	17.57	15.29	25.9	47.41
3.1.3	Jewellery	0.89	1.36	52.81	0.99	-27.21	2.49	2.64	6.02	2.57	-2.65
3.2	**Textile & Garments**	**193.6**	**200.44**	**3.53**	**192.8**	**-3.81**	**377.30**	**391.66**	**3.81**	**419.42**	**7.09**
3.3	Manufacturers	59.05	68.53	16.05	65.42	-4.54	108.07	142.24	31.62	146.68	3.12
3.3.1	Food, beverages & tobacco	3.03	3.62	19.47	4.90	35.36	4.96	7.50	51.21	11.2	49.33
3.3.2	Leather & leather products	5.12	3.10	-39.45	1.69	-45.48	9.97	5.50	-44.83	3.65	-33.64
3.3.3	Wooden products	0.90	1.70	88.89	0.96	-43.53	1.53	3.43	124.18	2.87	-16.33
3.3.4	Paper products	1.64	2.31	40.85	1.40	-39.39	3.02	4.14	37.09	3.3	-20.29
3.3.5	Rubber finished products	13.64	14.19	4.03	17.41	22.69	25.19	27.33	8.50	37.27	36.37
3.3.6	Chemicals & plastic products	5.35	5.94	11.03	6.31	6.23	10.05	11.73	16.72	13.49	15.00
3.3.7	Electrical & Mechanical products	4.02	6.79	68.91	8.16	20.18	7.22	12.14	68.14	18.46	52.06
3.3.8	Electronic products	5.09	5.65	11.00	4.58	-18.94	9.67	10.24	5.89	10.94	6.84
3.3.9	Ceramic & porcelain products	2.86	2.24	-21.68	2.95	31.70	5.65	4.84	-14.34	6.27	29.55
3.3.10	Footwear	1.92	2.54	32.29	1.72	-32.28	3.23	3.84	18.89	3.32	-13.54
3.3.11	Toys, Games & sports requisites	1.82	1.59	-12.64	1.82	14.47	2.84	3.12	9.86	3.81	22.12
3.3.12	Others	13.66	18.86	38.07	13.52	-28.31	24.74	48.43	95.76	32.1	-33.72
3.4	Petroleum products	4.11	2.92	-28.95	6.49	122.26	8.47	6.06	-28.45	12.77	110.73
4	Others	2.02	3.05	50.99	2.86	-6.23	10.76	5.60	-48.10	6.13	9.46
5	Re-exports	2.92	10.64	264.38	2.04	-80.83	4.46	17.57	293.95	7.11	-59.53
	Total exports	370.12	388.29	4.91	390.19	0.49	713.79	771.90	8.14	849.84	10.10
US $ Rate		93.54	96.86		98.55						

Source: Sri Lanka Customs: Central Bank
Analysis & Preparation – Policy Planning Division/EDB

Appendix D SC definitions analysed according to entities, activities and purpose

Definition	Entities	Activities	Purpose
Supply chain is the network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer. (Christopher, 1998:15)	Network of organisations, end consumer	Movement through up-stream and down-stream linkage	Delivering value added products and services to end consumer
When many exchanges take place between producers and consumers, the alignment of firms that bring products or services to the market has been called the supply chain or the value chain (Lambert and Stock, 2001:54)	Producers, various firms, consumers	Exchanges between producers and consumers Alignment of firms	Bringing products and services to the market
Supply chain is a network (group) of entities (members), formed to solve a common logistics problem. It is about managing co-ordinated information, material, and financial flows, plant operations, and logistics (Lee and Billington, 1993:836)	Network of members	Managing, co-ordinating flows, plant operations and logistics	Solving a common logistics problem

Appendix E Analysing SCM definitions analysed according to entities, activities and purpose

Definition	Entities	Activities	Purpose
Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders (Mills *et al*, 2004 and Lambert *et al*, 2001:54).	Products, services, information, original suppliers, customers, stakeholders	Integration of key business processes	Adding value for customers and other stakeholders
The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole (Mouritsen *et al*, 2003 and Christopher, 1998:18)	Suppliers and customers throughout the process	Management of upstream and downstream relationships with suppliers	Deliver superior customer value at less cost
The effort involved in producing and delivering and delivering a final product from the supplier's supplier to the customer's customer (Supply Chain Council, 2002)	Supplier's suppliers and customer's customers	Effort involved with produced and delivering	Producing and delivering the final product

Appendix F Purchasing versus Supply Chain Management

Category	Larson and Halldorsson (2002) observe
Traditionalists	"Traditionalists conceive SCM as a strategic aspect of purchasing, with emphasis on supplier development, and partnerships with first and second-tier suppliers…. An educator with this perspective may add an SCM chapter to the purchasing and supply management text, and/or insert an SCM lecture into the purchasing management course. A corporate purchasing department might hire 'supply chain analysts' to study second-tier supplier relationships"
Relabeling	"Relabelers simply change the name of purchasing to SCM. For instance, Giunipero and Brand (1996) suggested 'purchasing has already evolved to supply management in many cases, and to SCM in certain other cases. 'Tan Kannan, and Handheld (1998) described an evolution of purchasing into 'supply base integration', which they roughly equated to SCM. Note that relabeling narrows the scope of SCM, since in this view SCM equals purchasing".
Unionist	"This perspective sees purchasing as a part of SCM; SCM completely subsumes purchasing. In the extreme, SCM subsumes much of the traditional business school curriculum, including logistics, marketing, operations management, purchasing etc. According to LeMay et al (1999), 'supply chain managers are similar to purchasing managers', with the key difference being that supply chain managers have greater decision-making power".
Intersectionist	"The intersectionist concept is that SCM is not the union of logistics, operations, and purchasing. Rather it includes elements from all of these disciplines. SCM coordinates cross-functional efforts across multiple firms…"

Adapted from: Larson and Halldorsson (2002)

Appendix G A definition of Supply Chain

Definition	Key words	Reference
Supply chain is a network of organisations which may be dispersed across the globe, formed to solve planning and control problems of operational activities by aligning the firm's information, material and financial flows to produce value added products and services from original supplier to end consumer through reduced cost and improved customer service	Network	Sherer, 2005; Häkansson and Person 2004; Mills *et al*, 2004; Kemppainen and Vepsäläinen, 2003; Lysons, 2003; Lysons and Gillingham, 2003; Harland *et al*, 2001; Hakansson and Gadde, 2001; Kogut, 2000; Christopher, 1998; Lee and Billington, 1993; Harland, 1996
	Dispersed across the globe	Ettlie and Sethuraman, 2002 ; Meijboom, 1999; Harland *et al*, 1999; Akkermans *et al*, 1999; Christopher, 1999
	Planning and control	Lambert, 2004; Slack *et al*, 2001; Chandra and Kumar, 2000; Krajewski and Ritzman, 1993
	Managing the three flows	Lysons and Gillingham, 2003; Institute of Logistics and Transport 1998; Lee and Billington, 1993
	Produce value added products and services through reduced cost and improved service	Ettlie and Sethuraman, 2002; Kaufmann and Carter, 2002; Lambert and Stock, 2001; Christopher, 1998

Appendix H A definition of Supply Chain Management

Definition	Key words	Reference
The Supply chain management is the strategic co-ordination of the SC, aiming to achieve its full potential, improving performance and, purpose by developing-buyer supplier relations through information integration, in order to compete effectively with rival SCs.	Strategic	Gossman, 1997; Harland *et al*, 1999; Lambert and Stock, 2001; Slack *et al*, 2001; Stephens and Wright, 2002; Tan *et al*, 2002; Mouritsen *et al*, 2003; Lysons and Gillingham, 2003 and Waters, 2006
	Co-ordination	Simatupang *et al*, 2004; Zhao *et al*, 2002; Pires *et al*, 2001; Smith *et al*, 1995; Meijboom 1999; Lee and Billington, 1993; Chandra and Kumar, 2000; Daniels, 1999
	Potential, improving performance and purpose	Beach *et al*, 1998a; Beach *et al*, 1998b; Akkermans *et al*, 1999; Beach *et al*, 1999; Choi and Rungtusanatham, 1999; Vickery *et al*, 1999; Slack *et al*, 2001; Ettlie and Sethuraman, 2002; Fynes and Voss, 2002; Macbeth, 2002 and Colotla *et al*, 2003;
	Developing buyer-supplier relations	Sako, 1992; Swaminathan *et al*, 1995; Sheth and Sharma, 1997; Leonidou and Kaleka, 1998; Hakansson and Gadde, 2001; Fynes and Voss, 2002; Lambert, 2004; Fynes *et al*, 2005; McIvor and Humphreys, 2004 and Souviron and Harrison, 2006
	Information integration	Scott and Westbrook, 1991; Byrne and Javad, 1992; Daugherty, 1994; Gustin, *et al*, 1994; Swaminathan *et al*, 1995, Bowersox and Closs,1996; Emmelhainz, 1996; Beach *et al*, 1998a; Min and Gall, 1999; Lancioni *et al*, 2000; Lee and Whang, 2001; Pires *et al*, 2001; Poirier and Bauer, 2001; Van Hoek, 2001; Vorst, 2001; Gulledge, 2006; Modes, 2006 and Teng and Jaramillo, 2006
	Compete effectively	Scott and Westbrook, 1991; Byrne and Javad, 1992; Christopher, 1992; Jarillo, 1993; Billington, 1994; Baden-Fuller and Lorenzoni, 1995; Harland *et al*, 1999; Lambert and Stock, 2001; Macbeth, 2002; Christopher *et al* 2004 and Cetindamar *et al* 2005

Appendix I Table 27 Measuring criterion of BSR

Adaptation *Planning/ structural adaptation* Change of company objectives/ strategies/ policies Adjustment of original procedures/programmes Restructuring/aligning organization Personnel are specially appointed/trained *Procedural adaptation* Change of control procedures Adjustment of type/quality of work	**Distance** *Environmental distance* Economic/political-legal differences Differences in demographic profiles Differences in way of doing business Corporate distance Cultural difference with partner Similarity in organization values/attitudes Long way to learn partners ins and outs *Personal distance* Personal/friendly relations with partner Participating in social events with partner
Commitment *Corporate commitment* Preserving a long-lasting working relationship Devoting significant time to relationship issues Feeling of "attachment/belonging" to relationship Willing to put great effort into relationship Care about fate and prosperity of relationship *Personnel commitment* Personnel are geared towards serving partner Effort in learning "ins and outs" of partner	**Conflict** *Diversity of views* Different opinion on business venture issues Different perception of relationship problems Different ideas of future business development Different expectations concerning future actions *Tension/frustration* Existence of personality clashes/hostilities Friction due to unreasonable demands by partner Tension caused by stressful and anxious partner
Dependence *Partnership importance* Partner is important for company growth Continuation of the relationship is critical Partner major contributor in sales/profits Lot of money invested in the relationship *Replacement problems* Prohibitive replacement costs Not too much to gain from partner Ease of substitute partner with another	**Communication** *Communication sufficient* Adequate volume of information Accurate/precise information exchange Clear/understandable information Frequent exchange of information *Lack of communication barriers* Inadequate communication procedures Communication failures due to language differences

Satisfaction	**Trust**
Financial performance	*Honesty/trust/worthiness*
Very satisfied with partner's performance	Confidentiality of information provided
Partner is an excellent growth opportunity	Partner keeps us informed of development
Partner offers excellent sales/profits opportunities	Reliable advice/trustworthy recommendation
Behavioural performance	Fair and sincere in dealings with our firm
Proud of having this working relationship	Lack of fraud/lies
Feeling of disintegration in relation	Relations governed by hypocrisy/suspicion
Would not choose same partner in future	Deceit//cheating/fraud by partner
Cooperation	**Understanding**
Mutuality/reciprocity	Company understanding
Partner is conscientious/responsive/ resourceful	Partner's concern with own interests
Partner is helpful when we get into a tight spot	Poor understanding of our operations
Partner has our interest and welfare in mind	Lack of understanding common problems
Partner assists us in achieving corporate goals	Understanding problems/obligations
"Esprit de corps"	Understanding of relationships situation
Close co-ordination of actions with partner	Understanding of each others duties
Team spirit and co-operative effort with partner	Understanding common benefits
Joint effort in taking common problems	Partner's recognition of our company needs
	Understanding that working together is beneficial

Adapted from: Leonidou and Kaleka's (1998:397)

Appendix J Previous research on buyer-supplier relations

Study details	Hakansson (1982)	Rosson (1982)	Djeflat (1982)	Leonidou (1986)	Ford *et al* (1987)	Katsikeas (1989)	Johnson *et al* (1993)	Raveb *et al* (1993)	LaBahn & Harich (1997)
Data collection	Personal interviews	Personal interviews	Personal interviews	Personal interviews	Personal interviews	Personal interviews	Mail survey	Personal interviews	Mail survey
Key informants	Marketing/ Purchasing managers	Exporting/ Importing managers	Marketing/ Purchasing managers	Exporting/ Importing managers	N/A	Marketing/ Purchasing managers	Importing managers	Exporting managers	Senior executives
Exporting variables	N/A	Export sales Export experience	N/A	N/A	Export stages	N/A	N/A	N/A	N/A
Relationship variables	Adaptation/ Commitment/ Conflict/ Co-operation/ Dependence/ Distance	Adaptation/ Commitment/ Conflict/ Stake/ Performance	Adaptation/ Commitment/ Conflict/ Co-operation/ Dependence/ Distance/ Satisfaction	Conflict/ Co-operation/ Power/ Satisfaction	N/A	Adaptation/ Conflict/ Co-operation/ Distance/ Power/ Satisfaction	Power	Dependence/ Power/ Satisfaction/ Trust	Communication/ Conflict/ Performance
Analytical technique	Case studies/ Canonical correlation	Pearson correlation	Canonical correlation	Sign test	Case studies	Sign test/ Student t-test	Factor analysis	Pearson correlation/ Regression	LISREL

Notes: In some studies the fieldwork year was not disclosed, and this had to be inferred from the article's year of publication
Source: Leonidou and Kaleka (1998:376)

Appendix K Management Styles

Management style	Description
Dyadic Management	A dyadic approach to SCM may exist at numerous levels in the chain. Many organizations, in their early attempts to "manage" the supply chain, will focus only on those channel members with whom they have immediate contact. For example, an organization might try to improve coordination and communication among its first tier suppliers, carriers, and distributors. It may even develop some partnerships with key channel members. As the organization that is initiating a SCM approach works closely with its immediate channel members, those members may find that they need to work more closely with each other. This may spread throughout the supply chain, so that the supply chain is very well integrated and managed, dyad by dyad. Channel members may intervene from time to time with a nonimmediate channel member in order to help solve a problem, gain leverage, or improve communication but the firm's effort is concentrated on the adjacent firm. This approach to SCM is popular today because it does not require total central coordination and control, which can be both difficult and costly. Examples of organizations that follow this approach are Honda of America Manufacturing and Xerox Corporation. Both of these organizations form close working relationships with their immediate channel partners, and encourage these players to do the same. To further encourage synergy among channel members at the same level, Xerox invites noncompetitive suppliers into product development meetings, and encourages them to work together and to coordinate their efforts.
Channel Integrator	The channel integrator is an approach where one party, a channel leader, plays the key role in setting the overall strategy for the channel and in getting channel members involved in and committed to the channel strategy. Unlike the dyadic approach, where the communication is more indirect, the leader in the channel integrator approach has purposeful, direct contact with many key players throughout the supply chain. This approach is embodied by the clothing manufacturer and retailer Benetton, which coordinates the entire channel for its apparel, from contracting with the wool growers through capturing sales data at the retail level.' Another example of this is Chrysler, with its new model platform approach. Chrysler uses the extended enterprise concept, encompassing all tiers within the supply chain. Suppliers are an integral part of the Chrysler's teams. Chrysler encourages noncompeting suppliers to benchmark with each other and to share best practices. In its efforts to manage the total supply chain, Chrysler works with various levels in the supply chain to ensure that each knows its role, and is working closely with other links."

Analytic Optimization	In the analytic optimization approach, an organization, the channel leader, uses some sort of computerized modeling to determine the best supply chain configuration for its operations. Because of the many variables and interactions among factors, the result is a near optimal approach rather than true optimization. The key to this approach is that many supply chain cost and performance factors are quantified, and the supply chain is purposefully designed to best support a specific objective function. The objective function generally has multiple criteria, such as maximizing customer service, minimizing inventory, and so on. There may also be multiple constraints in terms of locations to be considered, capacity, tariffs and trade restrictions, and so on. Thus, the model may be very complex. Hewlett-Packard uses this type of approach"2 in designing its supply chains. It has an internal consulting group, strategic planning and modeling, which develops and runs the supply chain models. Digital equipment has used a computer model to reconfigure its worldwide supply chain and save $100 million.13 This analytical approach can be used to support decision making regardless of the managerial approach followed by the organization. For example, a firm could analytically design its desired supply chain configuration then attempt to manage it using an integrator style or a dyadic style
KEIRETSU	A final approach to SCM is Keiretsu/vertical integration. Like the channel integrator approach, this approach has a clear, centralized channel leader. However, the control/leadership is greatly empowered by partial ownership of the other channel members. Keiretsu is a Japanese "society of businesses" that relies on cooperation, coordination, ownership, and control to create a competitive upstream and down stream supply chain. In supply/manufacturing Keiretsu, there is a central manufacturer who manages and controls the channel through ownership interest in many of the channel members and interlocking directorates. Mitsubishi and Toyota are examples of this kind of keiretsu. Thus, Keiretsu has many of the benefits of vertical integration, without complete control.'4 Vertical Integration Vertical integration also achieves coordination of the flows but does not fit our definition of supply chains since there is ownership of most of the channel. Therefore, there is no coordination of the actions of independent firms. Vertical integration is an approach whereby there is common ownership of many supply chain members. An example of an organization with a high degree of vertical integration is General Motors. While Chrysler and Ford buy most of their parts from outside suppliers, GM buys the majority of the value of its components from such wholly-owned subsidiaries as Delco and Fischer.15 Vertical integration may offer greater control and market visibility. However, as noted by GM in its current attempt to use more outside parts suppliers, vertical integration may also create complacency among captive members of the supply chain.

Cooper *et al* (1997b)

Appendix L Analysing e-commerce (EC) and e-business (EB) definitions according to entities, activities and purpose

Definition	Segment	Category	Entities	Activities	Purpose
E-commerce is buying and selling of products and services over the internet (Golicic *et al*, 2002 and Kosiur, 1997:2)	Not clear	EC	Products, Services	Buying and selling over the internet	Not stated
E-business is the streamlining of all business processes in the value chain using Internet technology to improve the efficiency and effectiveness of the complete supply chain (Roelops, 1998, cited in Van der Vorst *et al*, 2002)	B2B	EB	Supply chain	Streamlining business processes	Improve efficiency and effectiveness
E-commerce refers to business activities involving consumers, manufacturers, service providers, and intermediaries using computer networks such as the Internet. The goal of e-commerce is to reduce product and service cost and improve customer response time and quality (Adam *et al*, 1999)	B2C	EC	Consumers, manufacturers, service providers, intermediaries, computer networks, Internet	Business activities	Reduce cost, improve customer response time and quality
E-commerce is the exchange of information across electronic networks, at any stage in the supply chain, whether within an organisation, between businesses, between businesses and consumers, or between the public and private sector, whether paid or unpaid E-commerce@its.best.uk (Cabinet office, 1999)	B2B B2C B2G	EC	Electronic networks, supply chain, organisations, consumers, public and private sector	Exchange of information	Not stated

E-business refers to technologies that provide effective and efficient ways in which corporate buyers can gather information rapidly about available products and services, evaluate and negotiate with suppliers, implement order fulfilment over communications and access post-sales services (Archer and Yuan, 2000)	B2B	EB	Suppliers, corporate buyers	Gather information, evaluation and negotiation, implement order fulfilment access post-sales services	Efficient, effective information gathering
E-business is the transformation of key business processes through the use of Internet technologies www.ibm.com/e-business (20/10/2002)	B2B	EB	Internet	Transformation of key business processes	Not stated
When a business has fully integrated information and communication technologies (ICTs) into its operations, potentially redesigning its business processes around ICT or completely reinventing its business model, e-business, is understood to be the integration of all these activities with the internal processes of a business through ICT (DTI 2000)	B2B	EB	ICT	Redesigning business processes, reinventing business models	Integration of all activities

EC: e-Commerce, EB: e-Business

Appendix M A definition of E-Business

Definition	Key words	Reference
E-Business is a platform for communications and information sharing between business to business or business to consumers, which enables the streamlining of business processes involved in SC, and may facilitate efficient, effective performance improvement in SCM.	Information sharing	Adewole, 2005; Li *et al*, 2005; Simatupang, 2004; Schneider and Perry, 2001; Poirier and Bauer, 2001; Archer and Yuan, 2000; Cabinet office, 1999
	Streamlining of business processes	Disney and Towill, 2003; Lee and Whang, 2001; DTI, 2000; Cunningham and Fröschl, 1999; Roelofs, 1998
	SC and SCM	Croom 2005; Cagliano *et al*, 2005; Chaffey, 2001; Vrost *et al*, 2001; Cabinet office, 1999; Kalakota and Whinston, 1997.
	B2B and B2C	Sherer, 2005; Power, 2005a
	Efficient effective performance improvement	Power, 2005; Quayle, 2002; Van Hoek, 200l; Min and Galle, 1999; Adam *et al*, 1999

Appendix N Table 19 Views 0f Poirier and Bauer (2001) on e-commerce and e-business implementation

Category	Poirier and Bauer (2001) argues;
Deny Internet's importance	*The first group are those who want to deny the Internet's importance, individuals who decry the magnitude of its force and pass off its impact as just another temporary trend that will leave little visible change in the way business is conducted. These people prefer focusing on improvement to internal operations, with or without an Internet technical architecture. For this group, the cry seems to be "Keep making better products and offering new services, and the customers will keep buying". This approach overlooks the fundamental changes occurring in buying habits and the technological advances that are impacting buying and selling relationships, which are moving inexorably towards Web-based features. Those in this category, which includes many companies in the up stream (primary supply) portion of supply chains, fail to seek the advice that could help them withstand the onslaught of this wave of change.*
Let other assume the lead	*The second group includes those who plan to ride out the impact of the Internet tsunami and repair the damage. Individuals who refuse to invest the time or resources to take a leadership position. This category prefers to let others assume the lead, content in the dangerous assumption that their organisations can gain back any ground lost to the deluge after its extent has been determined. These people believe a sound strategy is foregoing investments and applications until the one best format is created for using the Web for their specific applications. Individuals in this group, including many currently successful retailers, are destined to find their organisations with a gap that will require years to close before they catch the leaders.*
Runaway and hide	*Taking a more precarious perspective, people in the third category want to run away and hide until the wave has passed. Unable to handle technology in a global environment, they want to fall back on current capabilities, even if the result is the distribution of products and services that are in constantly declining demand through conventional channels. For this group, the legacy computer systems installed decades ago are good enough to keep pace with the burgeoning use of the Web. Expensive, slow, and error-prone, these non-integrated systems are an anchor on businesses forced to keep pace with swifter competitors. These people, including many manufacturing-orientated and distribution companies, will find their organisations consumed by those firms using technology to forge the new business responses demanded by the Internet.*
Ride the Web's wave	*Finally there are those who are prepared to ride the Web's wave to new heights of accomplishment, using cutting-edge technology as the defining element of differentiation, in a global business environment. Around the world, a new breed of business entrepreneurs is emerging, a group destined to establish leadership through applications conducted over the Internet. As these leaders of totally new businesses, led by those in high-technology and consumer distribution markets, raise enormous capital through the issuance of Web-based stock offerings, they are creating an impact on global commerce equal to that brought on by the industrial revolution. Indeed, we are witnessing a cyber revolution that will change forever the way business is conducted.*

Source: Poirier and Bauer (2001:ix-x preface)

Appendix O Comparing the performance of communication methods (in SCM)

Performance Measures	Direct-Link Telephones via Satellites, Microwave Dishes, or Terrestrial Cables *Circa 1960-1995*	Electronic Data Interchange between Computers, Specialises SOFTWARE *Circa 1970-1998*	Electronic Commerce, use of the World Wide Web and latest links *Circa 1995-2006*	Source
Speed	Faster than EDI, slower than EC	Slower than direct link telephones and EC	Faster than previous methods	Quayle (2002) and Min and Galle (1999)
Cost: Implementation	Less expensive than EDI and EC to implement	More expensive than direct-link telephones to implement	Most expensive to implement	Cunningham and Fröschl (1999)
Cost: Operating and maintenance	Less expensive than EDI, more expensive than EC to operate	Most expensive to operate and maintain	Cheaper than previous methods to operate	Van Hoek (2001) and Lee and Whang (2001)
Quality (i.e. Clear, error free information, minimal disruption)	Worst quality of information	Better than direct-link telephones, but poorer than EC	Best quality of information	Kosiur (1997)
Flexibility	More flexible than EDI, but less flexible than EC	Least flexible	Most flexible	Murillo (2001) and van Hoek (2001)
Security	More scure than EC, less secure than EDI	Most secure	Least secure	Cunningham and Fröschl (1999)
Quantity (of information)	Least volume	More volume than direct-link telephones, but less than EC	More quantity than previous methods	van der Vorst *et al* (2002)

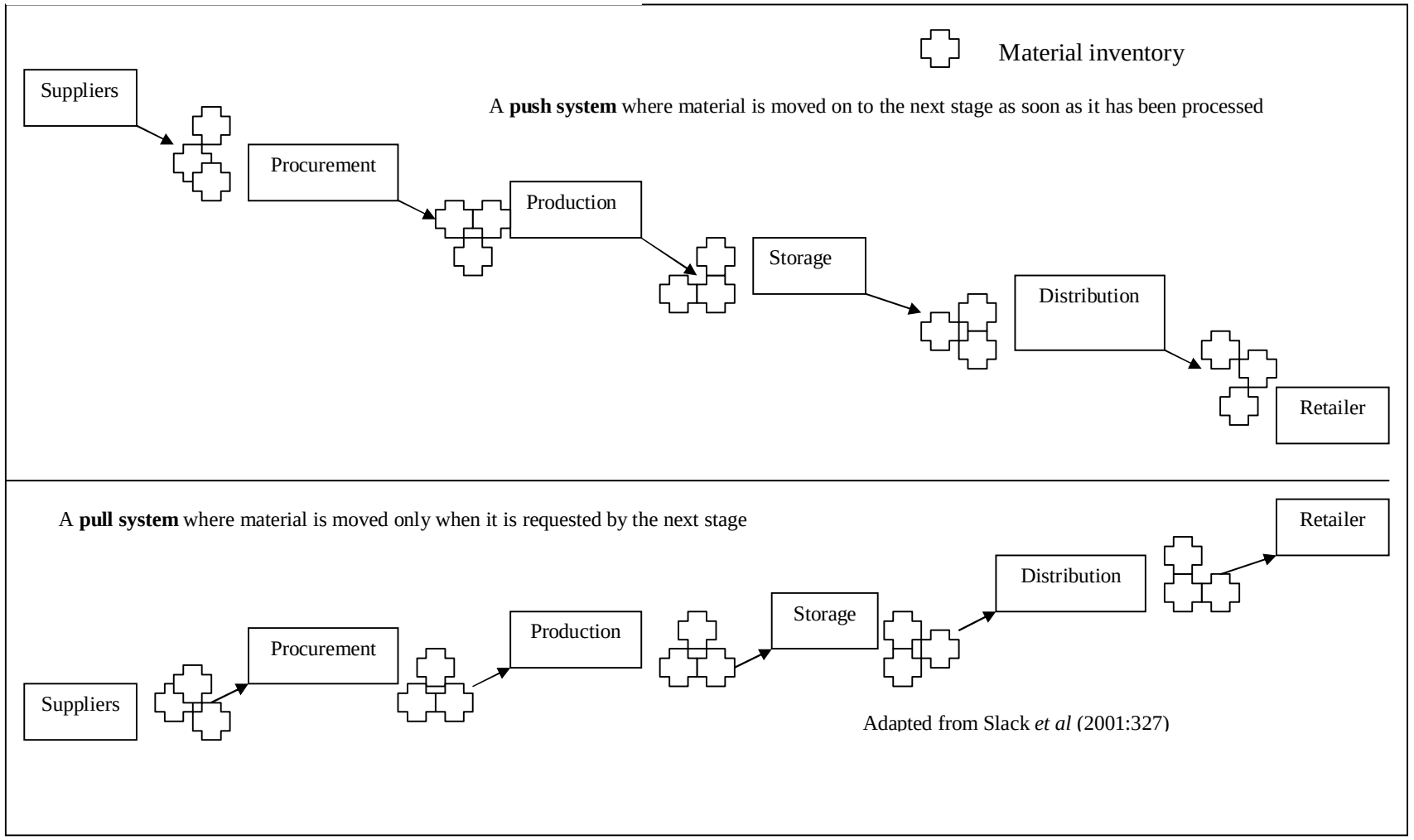
Adapted from: authors listed in the 'source' column

Appendix P previous research on electronic communications and its limitations

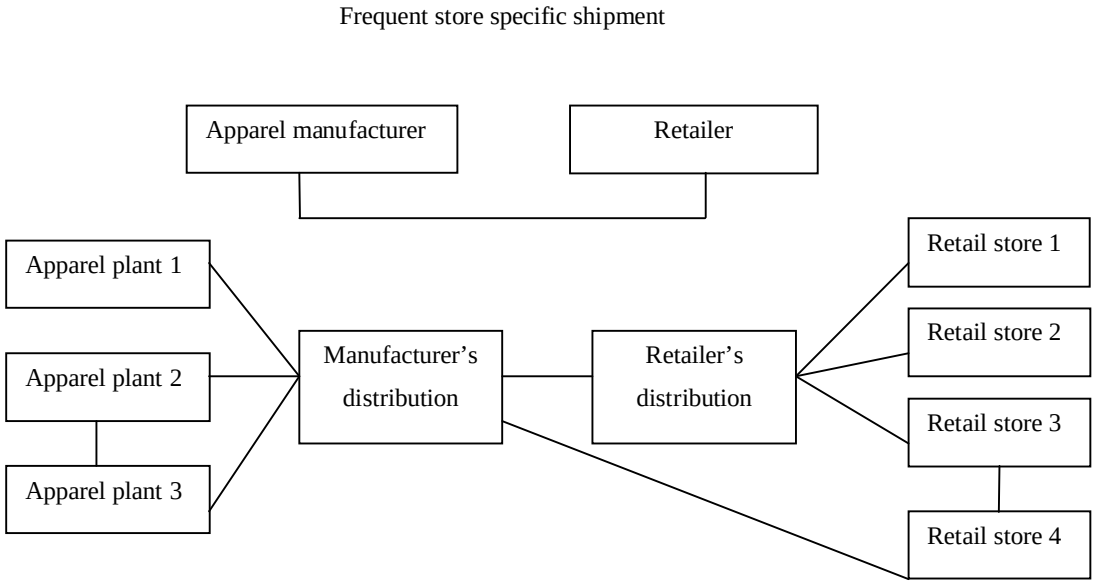
Authors	Article/book title	Research method	Findings	Limitations
Min and Galle (1999)	Electronic commerce usage in business-to-business purchasing	Questionnaires by mail	Larger firms use EC to establish supplier relations. Potential benefits of EC outweigh security concerns	EC is considered as a whole. No particular attention to information sharing.
Lancioni *et al* (2000)	The role of the Internet in Supply Chain Management	Questionnaires by e-mail	90.1% of the respondents use the internet in some part of their SCM	Low response rate (only 18.1%) from fieldwork. No details of information sharing.
Lee and Whang (2001)	E-Business and Supply Chain Integration	Literature review	Benefits of EC to SCM e.g. Avoiding information distortion, collaboration, synchronization	Descriptive paper. No empirical research. Anecdotal benefits are argued.
Van Hoek (2001)	E-supply chains-virtually non-existing	Company examples	Identifies the importance of integrating e-business rather than e-commerce with supply chain management. Claims e-commerce is fundamentally driven by sales and marketing.	Limited literature review. More practitioner orientated.
Quayle (2002);	E-commerce: the challenge for UK SMEs in the twenty-first century	Questionnaire survey method	Companies are not fully aware of the capabilities (strategic importance). Emphasis on training management and staff	Only UK SMEs are considered. Findings may not apply to large international companies.
Van de Vorst (2002)	E-business Initiatives in Food Supply Chains; Definitions and Typology of Electronic Business Models	Case studies	Shift in competitiveness from SC to supply webs. SC collaboration is growing in importance. Information sharing is critical for competitive advantage. Industry specific e-business models.	The author's views are very pro EC. Findings are mainly applicable to food industry.
Vakharia AJ (2002)	e-Business and Supply Chain Management	Literature review	Distinction between e-commerce and e-business. Current use of electronic technologies in SCM. Future research opportunities in information sharing, CRM, pricing mechanisms, etc	Descriptive paper. No empirical research. Only a starting point for research in this field.

Source: Literature review

Appendix Q. Push and Pull supply chain



Appendix R Lean retailing apparel supplier relations



The focus of lean manufacturing is to eliminate waste including time, to enable a level schedule to be established. Lean retailers require rapid replenishment of products, and shipments need to meet strict requirements in terms of the delivery times, order completeness and accuracy. Key to this is the use of bar codes, EDI and shipment marking. Source: Abernathy 2000 (cited in Bruce *et al*, 2004:153-154)

Appendix S Swaminathan *et al* (1995) model details

Scenario

Swaminathan *et al* (1995) consider the scenario with four entities (i.e. retailer, manufacturer and two alternative suppliers). The two suppliers differ in terms of cost, quality of service as well as the capacity allocations (supplier 1 is less expensive than supplier 2). By integrating supplier information and decision processes of the manufacturer the researchers analysed the effect on the cost incurred and quality of services provided by the supply chain (i.e. cost and quality are two SCM performance measures).

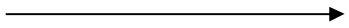
Details of the models

Model I – The suppliers and manufacturer share only average allocation figures. No dynamic information sharing

Model II – The suppliers are more closely linked with the manufacturer and are willing to provide their current capacity allocations

Model III – Only supplier 1 closely shares information with the manufacturer and supplier 2 shares only average allocation figures (limited information sharing).

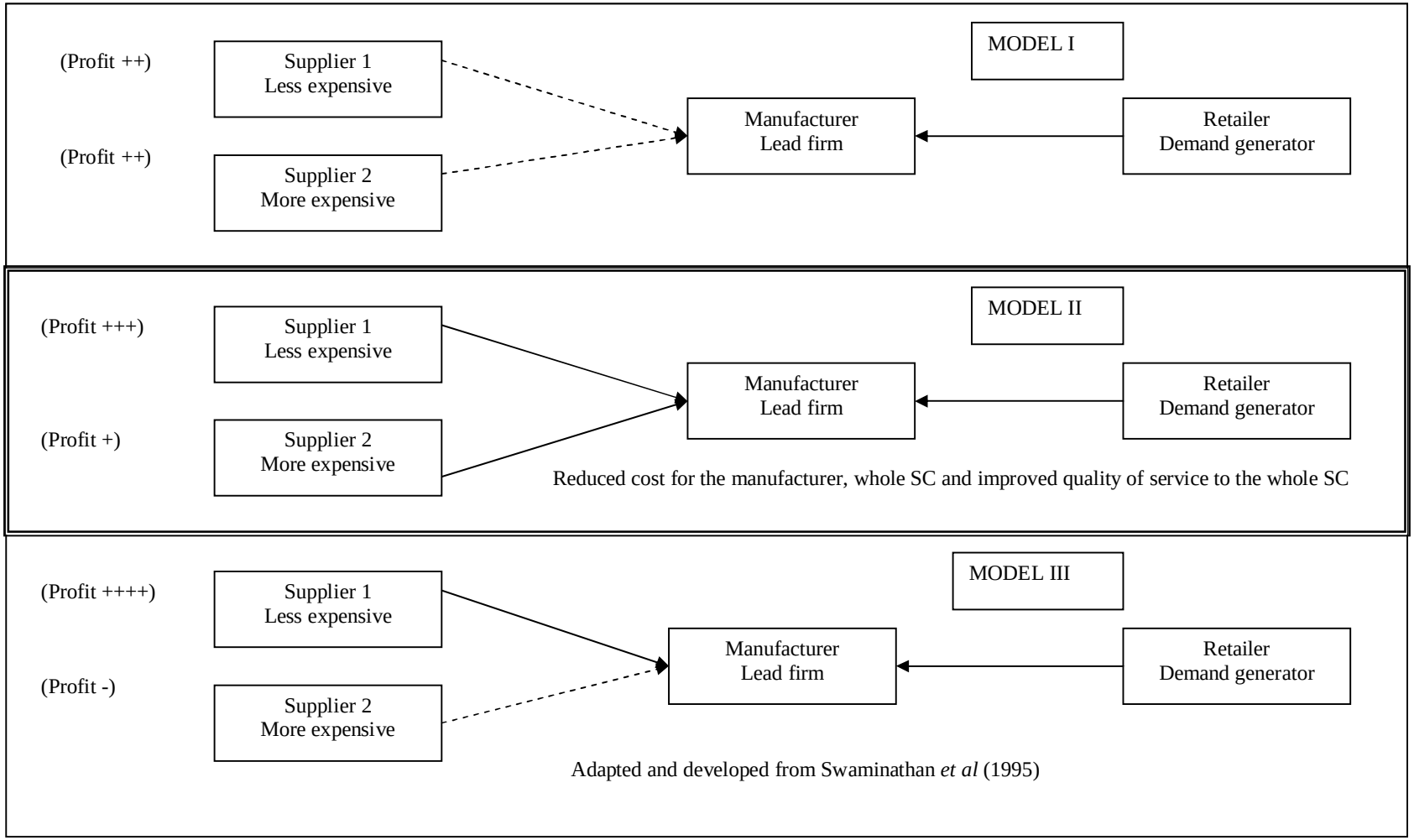
Average allocation (limited) information sharing



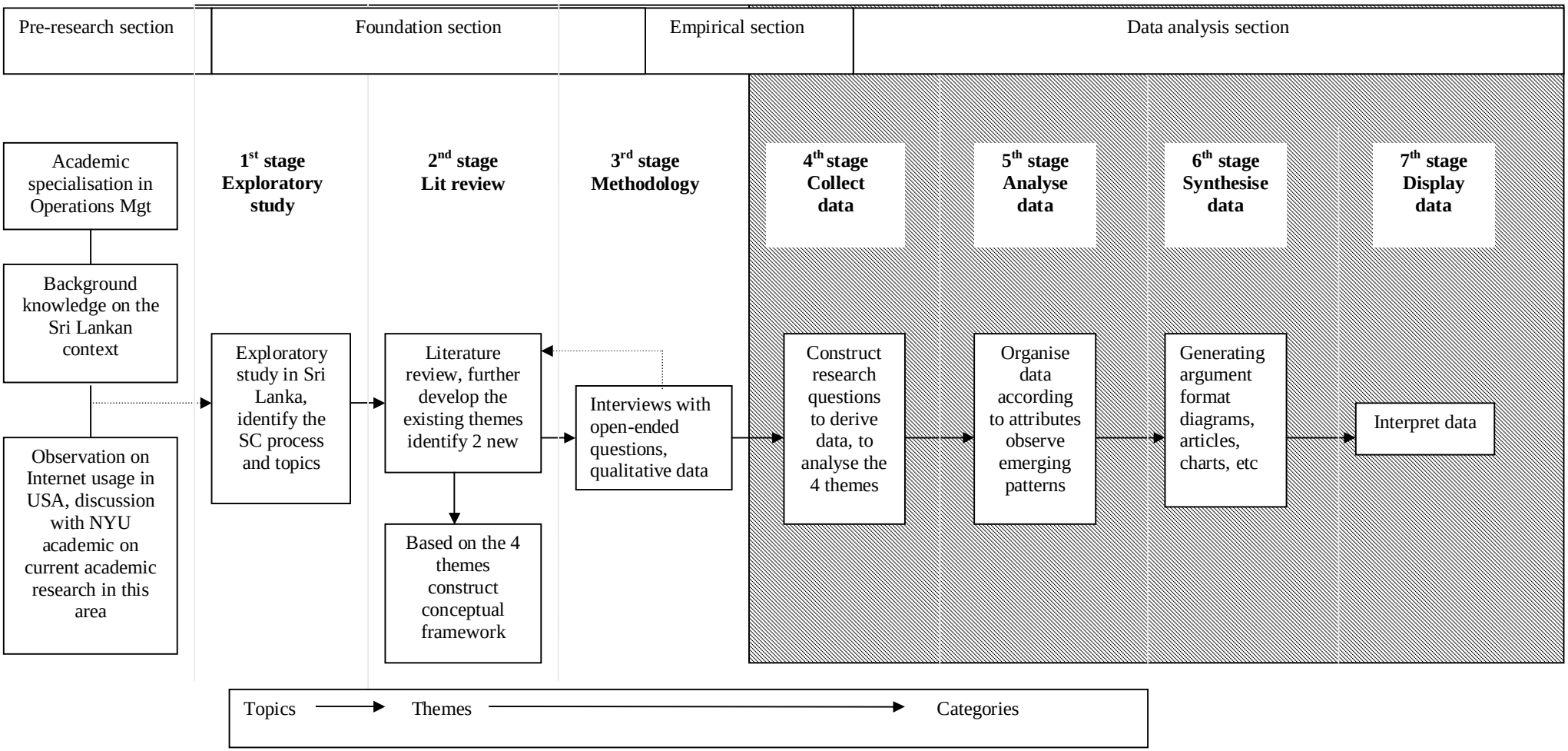
Dynamic information sharing

P.T.O

Appendix S diagram of Swaminathan *et al* (1995) model



Appendix T the research process in this study



Appendix U Role of the facilitator

The job done by Agent ‘A’ was valuable to this research and without his help it would have been unfeasible to set up interviews in an untrusting environment. After realising the potential benefit this research would bring to his work Agent ‘A’ volunteered to undertake the role of the main facilitator. This led to many advantages for the research process. Identifying subsequent links was perhaps the most useful advantage provided by him. Agent ‘A’ would provide unbiased opinion regarding who would be best person to interview and in difficult circumstances assist in arranging the interviews. Provide a channel for accessing sensitive information for the purpose of triangulating data. Identify company culture and norms, attitudes, character and general behaviour of respondents so an idea about best approach to guide the interview was gained (for more details see the interview structure). Perhaps the biggest advantage was research process refinement. Discussion with Agent ‘A’ helped to reflect on the research process by answering his questions such as ‘what are you trying to find?’ ‘why is that approach necessary?’ what kind of information do you expect to find speaking with him/her’ what more do you think you need?’, and more specific issues such as ‘what are your thought on group clusters?’ His questioning made issues clearer and focused attention on more important issues rather than peripheral matters. Time was saved by obtaining contextual information ahead of the interview. The questions were more informed, which created interest for the respondent. By making references to ‘hot topics’ the interview times were extended as the respondent were genuinely interested to answer questions with reference to situations prevailing within the company.

Appendix V Details of core respondents

Company	Position	Company	Position
Company A	IT Manager	**Company C**	Planning Manager
	Assistant Manager material Controlling		IT Manager
	Commercial Manager		Merchandising Manager
	Assistant Manager Operations		Managing Director
Company B	Group head ICT		Quality Manager
	Production Manager	**Company D**	Managing Director
	IT Manager		Head of IT (Corporate)
	CEO Procurement		Operations Manager
Company E	Ass IT Manager		Merchandising Manager
	Commercial Manager		General Manager - GLK HK
	Deputy Manager Merchandising		Merchandiser – GLK HK
	General Manager		

Appendix W Details of Expert Respondents

Job Post	Organisation	Description of Organisation
Assistant Director	Export Development Board	Government/Public
Head of IP and Broadband Section	Sri Lanka Telecom	Private
CEO	eWave	Private
Programme Specialist	ICTA (Information communication technology agency)	Government
Managing Director*	EDL (e development labs)	Private
SAP Consultant	Rapier consulting	Private
Director	Ace Cargo Freight Forwarder	Private
Superintendent Head of IT	Sri Lanka Customs	Government
Consultant Senior Economist*	Ministry of Policy Development and Implementation Ministry for Economic Reform, Science and Technology	Government
Managing Director	LJ International Private Ltd	Private
Senior Sales Mgr	Albert Lau - Hong Kong	Private
Proprietor	Sharprise Industrial Ltd - Hong Kong	Private
Assistant Director e-Business Research Unit	Hong Kong University	Public
** Same respondent with two different positions*		

Appendix X Participant request letter

University College Letter head

Mr. Asanka Gamage
291/38 Havelock gardens
Colombo 6.

05/11/2003

Name & Contact address

Research for academic purposes

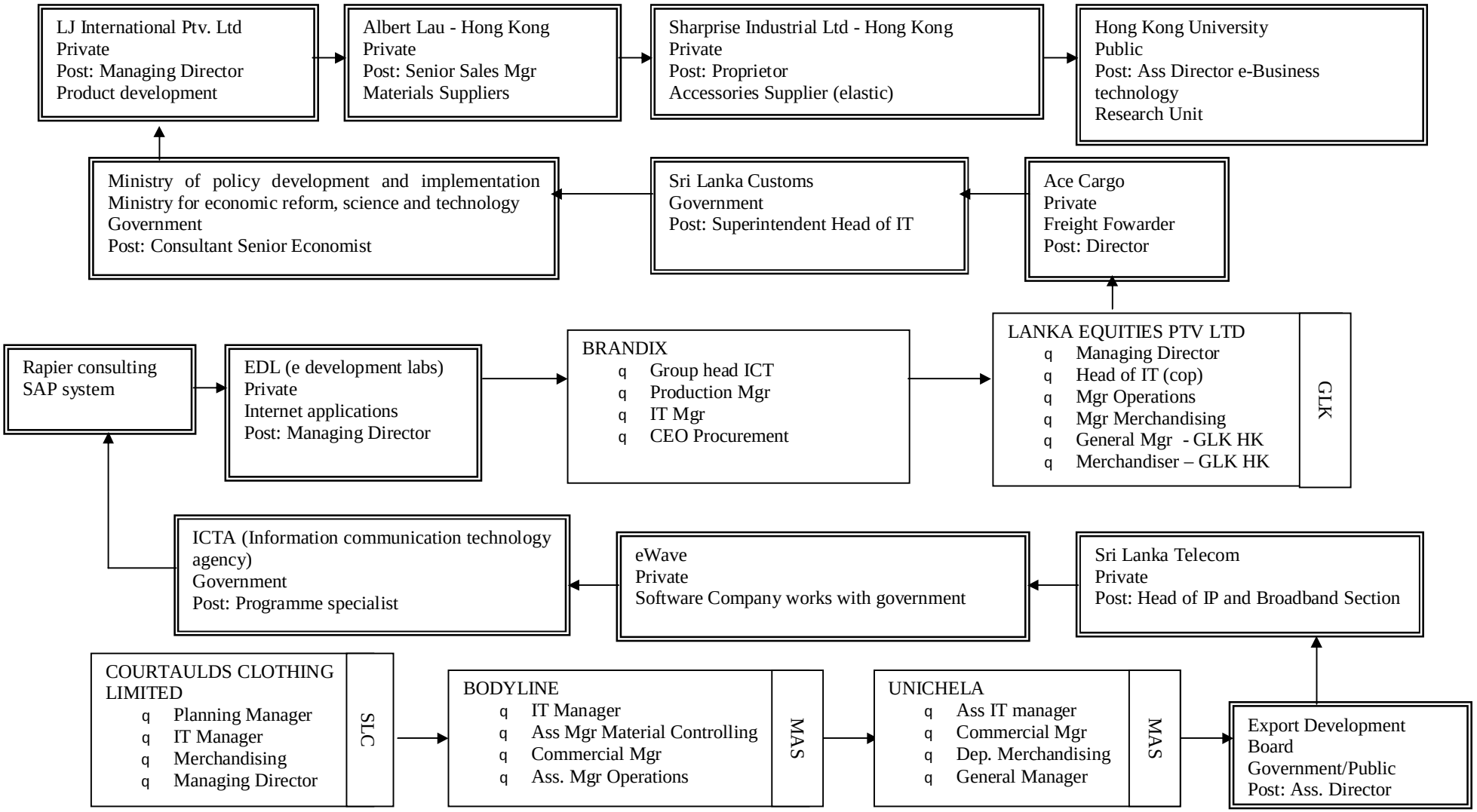
Dear Title name,

I am a Sri Lankan student undertaking a Doctor of Philosophy (PhD) degree at Buckinghamshire Chilterns University College registered at Brunel University, London. I have been studying in the UK for the last seven years during which time I have completed a BA (Hons) degree and a MBA. My specialised area is Supply chain management. Recently I have successfully completed the masters of Philosophy (MPhil) stage, which allows me to conduct the field research for my PhD. I have chosen Sri Lanka as my research field due to several reasons. The research is focused on exploring and identifying the underlying assumptions of supply chain practice, which may contribute to a better understanding of various information communication technologies (ICT) usage. My research focus is: *Investigation the impact of e-Business on Supply Chain Management in the apparel industry*. Effectively I plan to investigate the use of ICT as employed by Sri Lankan apparel manufacturers. This research is purely for academic purposes and the confidentiality of participants and information obtained will be assured. It is my understanding that your company is a leading apparel manufacturer in Sri Lanka and therefore your consent to participate will be greatly appreciated.

Yours sincerely

Asanka Gamage
PhD researcher
CC. Peter Sun (MD Sabre Technology)

Appendix Y Field work Nov 2003 May 2004 Sri Lanka and Hong Kong



Appendix Z Data Matrix

Respondents	Themes											
	Level of information sharing				Type of information sharing			BSR		Actual vs. Perceived impact		
	QI	CPI	AI	CSV	Ops	Tact	Strgic	E-BSR	Shift ICT	Anc Benefit	Anc problems	Hyperbole
I –IV company A												
I IT mgr												
II Materials controlling												
III Commercial mgr												
IV Operations												
V – VIII company B												
V Group head ICT												
VI Production mgr												
VII IT mgr												
VIII CEO procurement												
IX – XIII company C												
IX Planning mgr												
X IT mgr												
XI Merchandising												
XII Managing Director												
XIII Quality mgr												
XIV- XIX company D												

XIV Managing Director												
XV Head of IT												
XVI Operations mgr												
XVII Merchandising mgr												
XVIII General mgr HK												
XIX Merchandiser HK												
XX –XIII company E												
XX IT mgr												
XXI Commercial mgr												
XXII Merchandising mgr												
XXIII General mgr												
XXIV -XXXVI Expert interviews												
XXVI export development board												
XXV Sri Lanka telecom												
XXVI – eWave												
XXVII – ICTA												
XXVIII – Rapier												
XXIX – EDL*												
XXX Ace Cargo												
XXXI Sri Lanka Customs												
XXXII Ministry of: PDI, ERST*												
XXXIII JL international												
XXX IV Material supplier HK												
XXXV Accessories supplier HK												
XXXVI e-Business PhD HK uni												

Appendix Z1 Company D Merchandising manager interview transcript analysed according to attributes from the TAC framework

Quantity of information sharing (QI)

I: How often do incomplete messages happen?
When I came here there were lot of issues. 40% of time we were having issues about the data. This is mistakes not buyer problems. Mistakes made by merchandises. You can pin point it happened from this person, then you can identify who that person is we have done it actually. Things have for a greater extent stopped also with this Thomas group coming in. When it comes to procurement we came up with our issues saying we have that problem merchandises are not supporting not giving us the correct info.

How can your ERP system be improved?

In terms of the number of users at one time.

Communication platform integration (CPI)

How do you communicate with your customers?

Our customers are internal. They are the merchants. We communicate with suppliers what happens is all the order requirements are passed down to us by the merchants, based on which we start placing the orders. Customer contacts the merchants that's the marketing department and gives them 2this is my order get it costed" based on the prices they negotiate and take the order. Once they place the order the customer will say this is the item I need, this is the garment I need in that you have all the details it's called the BOM and that they indicate all the item that are necessary for ordering. Certain customers like Colombia and Nike are very specific. All the suppliers the suppliers are nominated so what happens is the buyer when he places the order he will communicate with his supplier. GAP makes last minute changes. Nike and Colombia know exactly what they want so we don't have a problem with them. Based on which we make something called a 'works order'. The merchants prepare something called a 'Trim Sheet'. It's like a BOM.

The EDI is not interlinked with suppliers and customer.

I: How well integrated is your info?

If it was say, there was a system where customer was in a situation to see where the production is to give us information and suppliers we can give the same way. If we can check where the production is of raw material would be really helpful. Because what happens here is you have to keep reminding them call them so much of things. I'm talking about procurement from suppliers. Because sometimes suppliers are slow to send a response. They won't get back to you. So for 2 weeks you don't have conformation. You don't know whether it's in production or not. If you call them even they wouldn't come to the phone. So we have problems like that. That doesn't mean sending a e-mail will solve our problems. We spend most of our time following up through e-mails and phone calls. Sometimes we end up faxing them also because

to see at least they will proceed that, you know some people have this reluctance to computes especially the Chinese (laughs). So we have these problems. If I was to say the system is integrated it would be better. The communication would be very much better. The flow would be very much better than what we are having right now.

I: What are the main problems in your SC?

There is no proper flow of info. Even between departments (internal) to department. There should be a flow of info from merchandising to procurement. Sometimes info I mean complete info is not passed to us mainly because they simply don't have the info or because they have made a mistake

Accessibility of information (AI)

What technology do you use to communicate?

E-mails, customer places orders through e-mail and EDI, all the details. Then the merchants will process it, negotiate get all the info, start entering to ERP, enter into 'fast react' and then they start doing all the primary works, and then info comes to us. Its physical documents generated by the ERP. It's printed out signed by the relevant heads.

Sourcing

Some sourcing we do it depends on the customer. For e.g. polly bags can be purchased from where we want. Packing items can be sourced from anywhere. Customer's like Van-Heusen they say you can buy from their shops. It the quality standards are approved the customer doesn't mind where you get it from, or how much you get it for, that's how it works.

Comparison Internet technology and previous technology?

Advantages

Cost, fast response, acknowledgement. One advantage you can get is you can get an acknowledgement. I should say they respond to it faster then to a fax because it just get lost. Practical problem we have what happens is for fax they also have a central thing where they receive the fax and they simply say they haven't received it. But e-mail we can always get a immediate conformation. You can keep going back to them without sending a fax each time you want to remind them. Time saving might be a reason to get a better response.

I: What has the internet done for your job?

Impact of EB? I can only talk about e-mails, here we do not use internet or another system between external links except only for tracking purposes. Not with suppliers we don't. So e-mails yes it might have helped a bit, it has helped. You can use it for all over the world, its fast, you get the responses better, it doesn't get lost, it's good for you to keep a track of things. Because you can store the mails, put reminders using excel you can plan everything through your computer. None communication of

information from suppliers to us is a person to person problem or a company to company problem not a process problem or what you say a mode problem. It's only that they are reluctant to give us certain info that we really need.

Cross structural visibility (CSV)

Why do you think there is a problem with integration?

Problem is ok…. There can be a problem sometimes there may be instances where situations go beyond their control, suppliers own control. E.g. they might not have the raw materials that they thought they had, export issues, colour rejection, etc. They will not give you the correct situation of their production. They say yes I will give you….. we don't go China to see whether they have produced the fabric or not. What they will tell you is yes we are in process they wasn't tell you how much they have finished or when you think you can get the goods, yes they will give you a conformation data on the delivery on a PI. Then they will say I'm sorry just couldn't meet it. That might be only known in the last minute because they just don't want to give us that info.

I: How has it changed business?

I had an order where I had to place the order through the internet for some tags. Initially what I did was very fast I should say because the moment I placed it immediately it was acknowledged, immediately it was sent for production it triggered purchasing other items. The web page lists all thee items they have so it's a matter of going and picking what is needed just putting the quantity because we knew the items we are purchasing. Because the buyer has informed us these are the items we need and its nominated supplier. So it says go through this person so we go there and place the order and a mail comes through confirming your delivery. It speeds up the process, and it immediately goes to the production plant saying this quantity is required without a person getting involved. For me to take this then look at and forward it there is a gap, you might miss certain things. Here all the specific fields is there. This is the quantity, this is the price, this is the delivery these are the colours, otherwise when your doing it you might miss certain information. They might have to come back again and ask is it this or is it that, here it's all specified and if you do not specify it will not let you go to the next screen or place the order. It will stop you there and say you haven't marked this field. That yes has helped, really helped. Because we put all the info and we will not miss, us being the customers the suppliers have all the info they need to proceed they don't have to come back to us or waste their time calling and asking is it that or this you want unless of course there were certain problems.

Security (Sec)

Disadvantages of EB?

Something crashed they are finished because of e-mail. If the server is down you can't get e-mail. Suddenly there are problems e.g. we had a time what ever mails we were sending to HK was not received. The mails from HK was not received here. There were some server problems and lines. Even the provider had problems. In those cases we have no other option we can't send mails, the communication comes to a complete

stop. You can't be faxing everything you want to say. The orders you're placing info they are requesting, you can't be calling all the time. Because one they get it immediately you get a response back. If you try to call them or fax them it doesn't work. They are totally dependent on it.

Operations (Ops)

From a technical point how does it work?

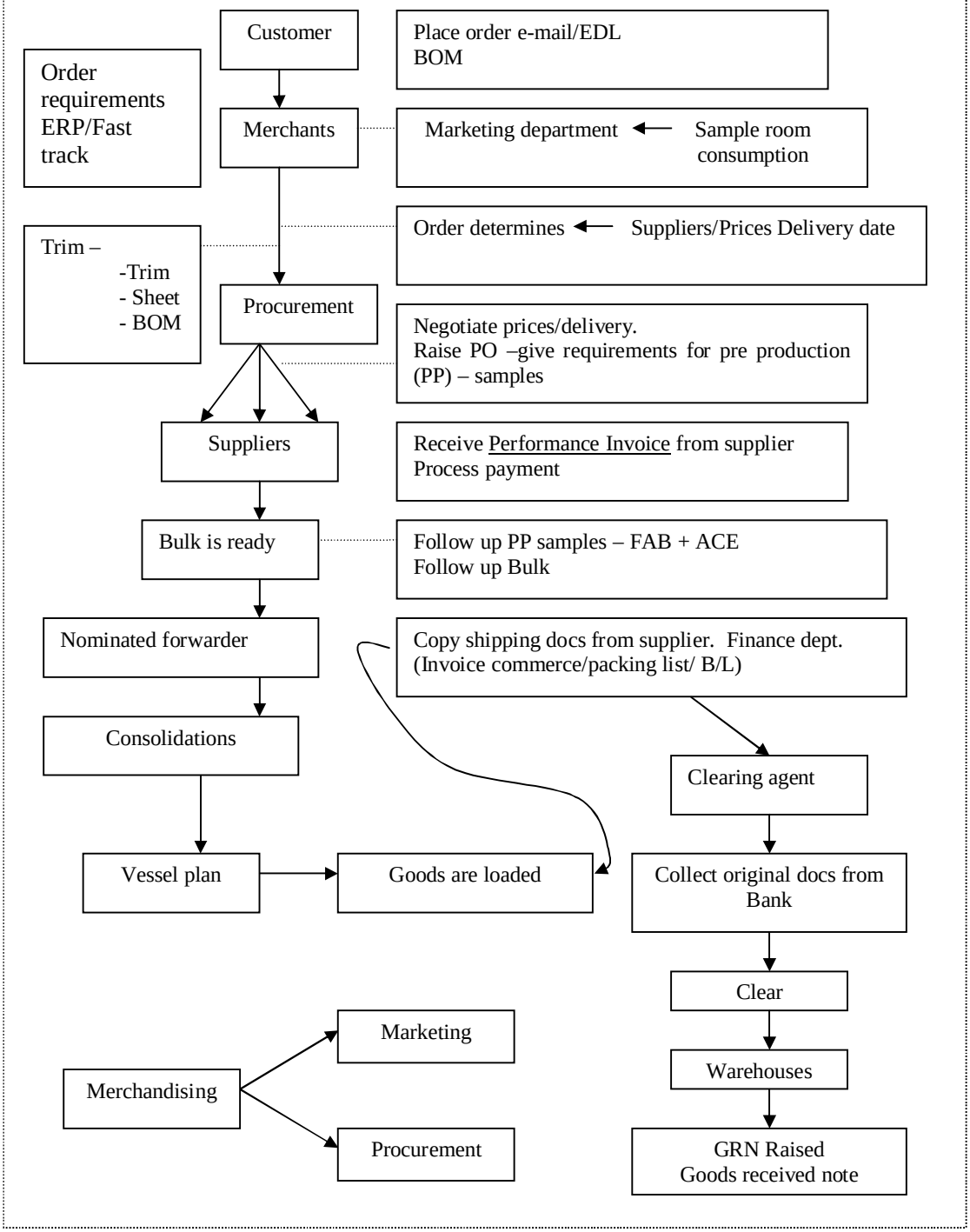
The ERP system that we have is not very user friendly training needed to enter info in to that system because each person in the department can't enter. It gets a bit complicated. The person who is not the data entry operator entering it would take more time because he won't be specialised in entering that info. So many fields that you need to fill in so many interlinks. So many prints popping-up there we have a problem with thee options. And then the data entry operator would perform then a coordinator or executive working here. But sometimes the executives will have to spend time creating the PO or what ever it is kind of a waste of time. It takes more time for processing. Again it could be crashing, stuck or system modification. Sometimes you might not have what you require because you don't have the same thing coming in everyday sometimes you might need an additional field in it. You might detect something is missing if you go to change it, it is again another tedious process. It's not like manual where you can cut it and say this is what I want. If I want to amend my PO I have to go back and change one by one sometimes you have to go to IT department to get it amended. That's a big process there. That I see as a implementation problem. So training is important how long it takes you to enter info to the system because speed is important. Some computers don't have the capacity to run the particular system on it might go slow it might get stuck somewhere, you have to restart the whole thing. I would say ICT becomes a headache after that because it can tend to so many other things as well, they are the particular problems I'm facing.

Transactional (Trans)

Customer places order with merchants. Merchants on receiving the order enters to ERP the BOM and also we have 'Fast react' that is controlling software it shows you when the order is entered. There is a certain time table given for each customer. It tells you when you should place your orders to suppliers, when you should get the goods in house, when you should start production. It creates the plan this is the 'Fast react'. (Diagram I represents a sketch by the merchandising manager describing the order process)

Once this info pass down the ERP we get a Trim sheet (like BOM). Based on this we raise purchase orders and then we get performance invoice from suppliers. It's a acknowledgement of order. Then we process payments. Initially when we raise PO we give pre-production samples that is fabric samples (colour dips etc). FABRIC and ACCESSORIES. Then follow up for bulk. Then we get shipping docs first we give a copy doc. Copy shipping document. Then if its L/C it comes to the Bank. We get the copy docs from the supplier we pass it to an agent.

Order process according to Merchandising manager at Company D



Commercial invoice, packing list B/L we pass it on to finance department. They will inform us the bulk is ready because we buy on FOB terms that means we take care of

freight. We have our nominates forwarders so when the bulk is ready we inform nominated forwarder. Then we look at consolidations because from HK we have different suppliers where bulk is getting ready at the same time. So we see what is ready and consolidate the shipment. Then goods are loaded. Once they are loaded we will get the Cus Docs and then we pass one set to finance department and we give this Cus Docs to our clearing agents. Clearing agents will collect original docs from us or bank and then they take are of clearing and delivery to our warehouse. GNR (Goods Received Note).

I: Externally what are the problems?

From customer to customer there are lot of problems Especially with GAP
E.g. 80% of the time you're not getting complete info from GAP. They give you the item they need next minute they will come and change it. They are not doing it on purpose.

I: What about your competitor's systems?

They are also using the same as us. Maybe their ERP system is much more user friendly. Processing times of purchasing orders our systems take a longer time. When I was in readyware I was part of a team implementing an ERP system. I joined there and they took me for that. It was so simple you just have to enter the order details all the purchasing orders were ready. Handling info was so easy so user friendly even amending it was so easy. Screens were so user friendly what ever I requested they were able to give me reports, PO duration everything was like there within minutes it was so good. Comparatively when I see our system here it's very slow. Their processing time is minimised.

How about doing something like online auction type thing?

How would you know about qualities you can't over the internet identify what is the item what are the fabrics looking at…… You can give me same 100% cotton 153:70 to 40 other person will give me 133: 70 to 40 quality will be different (she's talking about the feel) I need to have details.

Strategic (Strg)

You said most problems are due to communication. So do you think using something like EB would help you eliminate tat problem?

Not totally to a certain extent. The users have to be proper first. There was a supplier from Korea we were talking about systems and he was like "I don't believe in it. I don't know about it. I don't even want to think it. That's handled by different person" that was his attitude so how can you make it work with things like that. Yes technology can help to eliminate problems but I don't think it's been used to the maximum or people who are using it…..For e.g. for customers no point giving them all that connectivity and they try to make it easier if people were not doing it properly. They try to come and tell you no I can do this, T can't do that, I need to have this info that info, they just keep on delaying the process. Computers are fine this new systems when you connect them…maybe there just scared or something.

Supplier problem not only through technology or communication there are other issues as well. Within their plant they make mistakes they tend to miss out certain info or misinterpret info. For black say its grey.

What are your thoughts on implementing systems with high cost?

It has helped. But there are more important issues to deal with. Yes systems will help you but it's you who has to change the way you work and adopt to change and also be more efficient. Systems are forced on people. If I come to GL I should know how to use that particular system otherwise I won't be able to process anything so it disciplines people. Garbage in Garbage out.

Customer

I: From a technical point how does it work?

The ERP system that we have is not very user friendly training needed to enter info in to that system because each person in the department can't enter. It gets a bit complicated. The person who is not the data entry operator entering it would take more time because he won't be specialised in entering that info. So many fields that you need to fill in so many interlinks. So many prints popping-up there we have a problem with thee options. And then the data entry operator would perform then a coordinator or executive working here. But sometimes the executives will have to spend time creating the PO or what ever it is kind of a waste of time. It takes more time for processing. Again it could be crashing, stuck or system modification. Sometimes you might not have what you require because you don't have the same thing coming in everyday sometimes you might need an additional field in it. You might detect something is missing if you go to change it, it is again another tedious process. It's not like manual where you can cut it and say this is what I want. If I want to amend my PO I have to go back and change one by one sometimes you have to go to IT department to get it amended. That's a big process there. That I see as a implementation problem. So training is important how long it takes you to enter info to the system because speed is important. Some computers don't have the capacity to run the particular system on it might go slow it might get stuck somewhere, you have to restart the whole thing. I would say ICT becomes a headache after that because it can tend to so many other things as well, they are the particular problems I'm facing.

I: How well does your Lead firm communicate in the SC?

E.g. Trim-sheet we are using it's like a BOM info in that 'trim-sheet' is incorrect sometimes you might pick the wrong supplier. What happens is when we raise purchase orders we get stuck we have to go back and re-check we have to do the whole thing on ERP to raise the PO. If they pick the right info it's a matter of just printing out running the MRP and getting the PO done. But if it's the incorrect info then you have to delete the works order of the whole thing again. That's a mistake. Other thing is the buyer. The buyer might like certain breakdowns colours things like that or they might not even confirm the item to you at the beginning for e.g. GAP. What happens is they tell you they need a label but they will not tell you what label they want. Today they will tell you it's 18 line button and tomorrow they will say they don't want it they want something else. We have to be se fast like as soon as the info

comes we have to immediately go back to the supplier because what happens is they have their contacts with suppliers (because they are nominated) while they are negotiating with us giving us the info they also negotiating with suppliers, they are looking at different samples, we don't do development for them they take the development from suppliers and they look at it and confirm it directly to the supplier. It's a matter of us giving saying this is the button we want and a matter of supplier sending to us. We don't get involved with the buyer and supplier. Specifically for GAP. For certain other customers we do the development and some you don't even have to do the development it's all done and dusted. Specific thing that they want they'll tell you this is what I want you better go and purchase it.

I: How does the relationship help to gain autonomy?

It depends on the customer someone like GAP makes last minute changes because they have to wait until minute to decide because they also predicting for a different season. So the autonomy they can give us is kind of very limited. All the suppliers are nominated they also work on a connection or commission basis or something like that. They don't want to let go of that. Sometimes they will say this is your issue with the supplier so they don't get involved in it. At times suppliers will go directly to customer so GAP itself will sort-out the problem. If the supplier makes a mistake and we tell them look you made a mistake you better re-ship it or re-do it what they do is they go to GAP and discuss and GAP accept it and we don't have to re-do it. The supplier has a better relationship with customer than we have when you place the order they have already started working on it they knew a order like this is going to come.

Effect on BSR (E-BSR)

I: What are your thoughts on info sharing? (Preserving competitive advantage)

What I'm looking at is SC would be a win: win situation for all. What you have to build-up with your suppliers and forwarders is trust, and also a good relationship. The advantage of having a SC is integration and having a win: win situation to all. You be the supplier for example I'll be the customer. You are my supplier. If you leaked-out my info to another supplier what does that mean? I will lose my order which means you will lose business from me. That part of the thing yes I will build up and then we have to work on it. Relationships are very much important it's all interlinked relationships because the success of one person will depend on number of suppliers in that link, that everybody in the link should understand and also links should be formed only if those suppliers and customers are reliable to form such a link. First you should have a good experience with the a good relationship with them without it you can't just go and have a integrated relationships with a new supplier who just walks in because you don't know about them they don't know about you. You can't build a relationship just over a month or one dealing. Through dealing through experience you should know whether it's reliable to have integration. That will be like this particular item I'll have 1 or 2 suppliers so I know who I'm working with rather than having a full base here. I should start selecting suppliers based on relationships and monitoring how they respond on prices…monitoring like a supplier score card, rating them appraisal.

Negotiations (Neg)

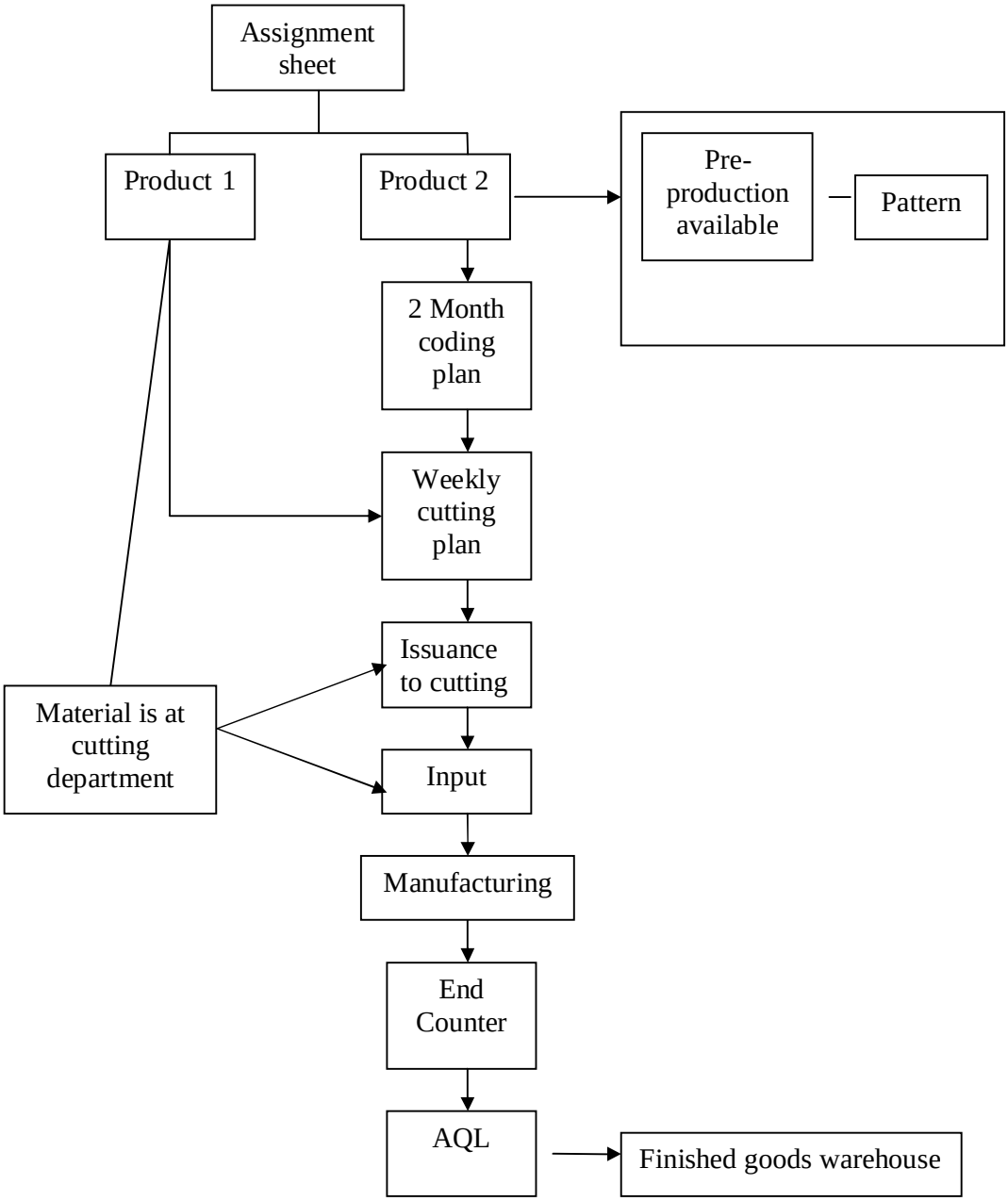
Impact on your business?

We are not doing anything at moment on internet just e-mail. I did 1 or 2 orders over the internet where it was easy for us to access the suppliers place the order and the next minute it was processed. If that works it's very much easier for us because we don't have to place for conformation you enter your order its their responsibility to make sure they produce for that order. They can't miss out because the product is given you just keep on collecting it. There is no need for negotiations as such happening there, or trying to make them understand or for them to make you understand. So it did help. But what I'm trying to tell you is that over the internet if your trying to place orders for certain items like what we are dealing in like fabrics, trims where you have to keep all info, then how will it work. How will they facilitate that? Even though you place orders over the internet the negotiations will have to go through mails. So internet as such would not impact on our side of the business because in any case you will end up e-mailing each other negotiating for prices. The price changes based on description even colour of the item so certain time you have to go through mails. So internet as such would not impact on our side of the business because in any case you will end up e-mailing each other negotiating for prices. The price changes based on description even colour of the item so certain times you have to go and explain to them what your wanting especially when you're sourcing for the item. First you have to source for the item say look do you have this quality and if you have give me this quality I will look at it then if I like everything then I'll place the order. Definitely the information communication has to be there.

Barriers

Lack of government support. They don't cater to our urgency. They are not bothered. When we ask them to speed things up they say 'what's your rush'. It's people problems influencing systems.

Appendix Z2 Company A, Production cycle according to operations manager



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